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# Attrition of Nonprior-Service Reservists in the Army National Guard and Army Reserve

David W. Grissmer, Sheila Nataraj Kirby

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# **Attrition of Nonprior-Service Reservists in the Army National Guard and Army Reserve**

David W. Grissmer, Sheila Nataraj Kirby

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Prepared for the  
Office of the Assistant Secretary of Defense/  
Reserve Affairs

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## PREFACE

This report analyzes the attrition of Army Reserve and Army National Guard enlistees who have had no prior military service. The analysis was conducted for the Office of the Assistant Secretary of Defense (Reserve Affairs) by Rand's Defense Manpower Research Center under Task Order 84-III-1, program area III—Reserve Forces Supply and Management, Contract MDA903-83-C-0047.

Each year the Army National Guard and the Army Reserve enlist between 120,000 and 160,000 individuals to maintain strength levels. Currently, about one-half of these enlistees lack prior service and thus need basic and skill training to qualify in a military occupational specialty. The cost of recruiting and training varies with the length of training, but it can easily reach \$5000 per recruit. Personnel who leave the military before completing their term of service cause the Army to incur training expenses, but they fail to fully repay this investment through service.

The Army can reduce training costs by improving (1) the selection criteria for recruits and (2) the balance between recruiting resources and training costs. By increasing recruiting resources, the Army may attract higher-quality recruits and lower training costs with a net budgetary saving.

The report develops models of attrition that assign a probability of attrition to each recruit type. The models are based on an analysis of historical attrition for the fiscal year 1980 cohort entering the Army National Guard and Army Reserve. It extends work at Rand on reserve attrition reported by the same authors in N-2079-RA, *Attrition During Training in the Army Reserve and Army National Guard*, August 1984. The present study develops models for attrition during the training and posttraining period and for the first two years after enlistment. It also distinguishes between separation to civilian life and separation to the active force or to a reserve component (including return to the same component). By identifying recruit characteristics likely to lead to separation, the analysis provides a basis for improving enlistment standards.

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## SUMMARY

The Army Reserve and Army National Guard annually enlist approximately 70,000 individuals who have had no prior military experience. These enlistees receive full-time training to qualify them for a military occupational specialty (MOS). Their training, which is the same as that given to U.S. Army enlistees, varies in length from four months to over one year, depending on the MOS.

The marginal cost of the training, including military pay during the training period, can vary from \$4000 to over \$20,000 per individual. The return from this training investment to the reserve components comes as the individual serves the full term of enlistment, usually six years. The high rate of separation prior to the completion of the six-year term substantially reduces this return. Estimates from our projections based on the FY1980 cohort show that approximately six in ten Army guardsmen and three in four Army reservists will separate before completing the full term.

These high separation rates increase both accession and training costs significantly by raising the number of accessions required to maintain a given reserve force size. This problem may become critical in coming years, when the decline in the 17- to 21-year-old population pool will make recruiting more difficult and more expensive. Thus, reducing attrition may be the key to achieving the scheduled growth in the Army reserve components over the next several years. Increased strength levels will be much more easily maintained if ways can be found to keep first-term reservists until the end of their term.

This study analyzes attrition of the FY1980 nonprior-service enlistment cohort of Army guardsmen and Army reservists during the first two years of their enlistment. The separation rate during this period was 30.6 percent for the National Guard and 39.5 percent for the Army Reserve. We hypothesized three causes for these levels of reserve separation: the quality and demographic composition of the enlistment cohort; transfers to the active force or to a reserve component (including returns to the same component); and the difficulty, for young people, of holding a moonlighting or extra job during a time when they are entering the full-time labor force, building a career, marrying, and starting a family.

The data for the analysis were developed at the Defense Manpower Data Center (DMDC) from the Reserve Components Common Personnel Data System (RCCPDS) by merging enlistment records, quarterly personnel records, and separation records for each enlistee in the

FY1980 cohort. In addition, for each separation record a search was made through later active and reserve force files to determine whether the individual had enlisted in the active force or in another reserve component or returned to the same component within the two-year period.

Statistical models of separation were estimated using a logit functional form to analyze the determinants of the separation decision. These models can be used to estimate the probability of attrition for an individual with any combination of characteristics.

The models were estimated for three time periods: separation during training, separation after training but before the end of the two-year period, and separation during the entire two-year period. For each period, we used two definitions of attrition. The first includes individuals who separate to civilian life and do not return to the military; the second includes those who separate to civilian life and those who separate to the active force or to a reserve component (including return to the same component).

These definitions reflect two disparate viewpoints. From the point of view of the total force, attrition to civilian life is the central problem since some recoupment of training investment is obtained if an individual stays within the total force. From the viewpoint of the individual component, however, separation from the component—regardless of the destination—is the critical variable, since turnover lowers readiness and raises component manpower costs.

The results show that separation rates for both components, like those for the active force, are sensitive to the education level, aptitude scores, and demographic composition of the enlistment cohort. Other things equal, women have significantly higher attrition rates than men, high school nongraduates have significantly higher separation rates than high school graduates, and those with higher aptitude scores have lower attrition rates. Race proved to affect attrition less than the first three factors, but showed different patterns for men and women enlistees. Marital status and age have a much smaller effect but also tend to have different patterns for men and women enlistees.

If only separations to civilian life are examined, the Guard and Reserve have somewhat similar levels of attrition. The Reserve loses 28 percent to civilian life; the Guard, 25 percent. The results also show that many reservists separate to enter an active or another reserve component, or to return later to the same component. This category of separation constitutes 28 percent of Army Reserve separations and 17 percent of Army National Guard separations during the first two years. Among those separating who later return to an active or reserve component, 70 percent to 75 percent enter the active force; the remainder

return to a selected reserve component. An analysis of the quality of the three types of separations shows that those going to the active force are the highest quality and those returning to civilian life are the lowest quality.

Reservists typically tend to be 17 to 25 years old. Reserve attrition patterns may thus be shaped by the many competing demands on reservists at this stage of their lives. These demands typically involve entry into the full-time labor force, building a career, marrying and starting a family, and perhaps further education. Such transitions may include frequent changes of full-time job, several moves of residence, and increasing family responsibility. Family and employer conflicts, shown to be the leading causes of separation at the reenlistment point, probably also operate during the first enlistment term.

Geographic moves away from the local reserve unit often cause separation from reserve service. Linkup with a new unit may be uncertain because of skill mismatches or lack of vacancies. Our results are consistent with the hypothesis that groups with greater geographic mobility and earlier marriage are more likely to separate. In particular, the higher separation rates of women may result from earlier marriage and more frequent geographic moves. Additional analysis linking survey data could further test these hypotheses.

The timing of attrition differed markedly in the Army National Guard and Army Reserve. For the Guard, 70 percent of civilian attrition occurred during training; for the Reserve, only 28 percent occurred during training. The statistical pattern suggests that lower levels of training attrition lead to higher levels of posttraining attrition. It suggests also that individuals who survived Guard training were more highly selected and thus less likely to leave after training. For the Reserve, the pattern appears to be the opposite. These patterns may reflect the different screening procedures used for combat-oriented skills in the Guard in contrast to combat-support skills in the Reserve. They may also result from different training policies in the two components.

The results point to a number of areas requiring further research before policy initiatives are undertaken. These areas include more intensive use of survey data for gathering information on attrition. Reserve attrition files could be linked to existing reserve survey files and longitudinal civilian data files. Simultaneous analysis of several recent cohorts would help researchers to understand the effect of training and personnel policies on attrition. Finally, the attrition of prior-service enlistees could be analyzed and the results combined with

enlistment supply models for both nonprior- and prior-service enlistees in order to determine substitution possibilities between the two types of enlistees.



## ACKNOWLEDGMENTS

The Defense Manpower Data Center created the cohort file underlying this analysis. We thank Lou Pales, who patiently worked with us to develop the file specification, and Terry Kohler, who constructed the analytic files. We thank our Rand colleagues Julie DaVanzo and John Winkler for their insightful and careful reviews and James Hosek for his helpful comments on an earlier draft. Priscilla Schlegel provided excellent research assistance, and Barbara Eubank cheerfully and efficiently typed several drafts of this study.

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## I. INTRODUCTION

The United States Army Reserve and Army National Guard annually enlist approximately 70,000 individuals who have had no prior military experience. These individuals receive full-time training to qualify them for a military occupational specialty (MOS). This training, which is the same as that given to U.S. Army enlistees, varies in length from four months to over one year, depending on the MOS.

The marginal cost of the training, including military pay during the training period, can vary from \$4000 to over \$20,000 per individual. The return from this training investment to the reserve components comes as the individual serves the full term of enlistment, usually six years. The high rate of separation from the components prior to the completion of the six-year term substantially reduces this return. Estimates from our projections based on the FY1980 cohort show that six in ten Army guardsmen and three in four Army reservists will separate before completing the full term.

These high levels of separation among nonprior-service reservists in the Guard and Reserve have caused much concern among military manpower planners. Early attrition, i.e., separation from the unit prior to completion of the enlisted term of service, lowers force size and force readiness and raises total training and recruiting costs.

Several possible explanations may be suggested for these reserve attrition rates. Active force attrition research has shown that individuals with lower educational attainment and aptitude scores have markedly higher attrition rates. Thus, if the determinants of reserve and active attrition are similar, the low quality of reserve enlistees may explain the high reserve attrition rates.

Other explanations center on the moonlighting nature of the reserve job and its inherent potential for conflict with full-time employers and families. The high mobility rates of young people, who must sever ties with the local reserve unit when moving and who face uncertain reserve job availability in a new location, may further exacerbate the attrition rate.

Finally, a reservist may separate from a reserve component to join the active force, or may separate but later return to the same or another reserve component. From the total force point of view, such separations would not be attrition losses. If such transfers occurred frequently, the attrition rates from individual components would overstate the extent of the problem.

This study analyzes attrition during the first two years of service, using the 1980 nonprior-service cohorts entering the Army National Guard and Army Reserve. Models predicting the probability of attrition for enlistees with differing aptitude scores, educational attainment, and demographic characteristics are developed. These models are estimated separately for the two components and for three time periods: prior to the completion of training, the period after training to two years, and a combined model for the entire two-year period.

Because our models give attrition probabilities for enlistees having different characteristics, the results can determine the extent to which enlistee quality is a factor in attrition. The models also allow us to test the relationship between selected demographic variables and attrition. Our theory suggests that variables associated with a greater likelihood of change in job, location, or marital status would also lead to higher attrition; we find this to be the case.

The models also distinguish between reservists who are lost to civilian life as opposed to those joining the active service or a reserve component (including return to the same component). Since some of the training investment is recouped if the individual is not lost to the total force, it is important to be able to estimate different models for these groups with different loss destinations. Such models also help to determine the extent to which reserve attrition statistics are inflated when these latter groups are included as losses.

Finally, some inferences concerning the effectiveness and efficiency of recruitment and attrition policies in the two components may be drawn by comparing the attrition models for the Guard and Army Reserve. These policies include setting enlistment and training standards, relative emphasis on prior-service versus nonprior-service enlistments, and policies concerning geographic relocation of reservists.

The results show the importance of including the destination of loss when analyzing reserve attrition, particularly for the Army Reserve. Whereas the two-year separation rate for the Reserve was 39.5 percent, over one-fourth of those who separated later returned to the active force or to a reserve component. For the Guard, the two-year separation rate was 30.6, with approximately one in six returning. Even excluding those who returned, the two-year loss rate for the two components was 25.4 percent for the Guard and 28.3 percent for the Reserve.

The timing of separations for the two components, however, appears to differ considerably. The Army National Guard loses 18.8 percent of the enlistment cohort before the end of the training period. In contrast, the Army Reserve loses only 8.9 percent during the pretraining and training period. The posttraining attrition rates show the opposite

trend, with the Reserve having much higher attrition rates than the Guard. During the period from the completion of training to the end of the second year, the Army National Guard, perhaps because of the stringent early screening, loses only another 11.8 percent of the cohort, while the Army Reserve loses 30.6 percent of the cohort.

This study also verifies the importance of education and aptitude scores in predicting separation. Like the active force, the Army Reserve and National Guard show large differences in separation rates between high school graduates and nongraduates for otherwise similar individuals. Controlling for education and other factors, we find that mental category<sup>1</sup> also strongly affects separation rates. However, the largest differences in separation rates occur between similar men and women. Other things equal, women have approximately twice the separation rates of men.

Section II develops a theoretical model of attrition. Section III presents the demographic statistics describing the 1980 cohort and the cohort attrition rates by timing of loss and destination of loss. Sections IV and V report the empirical results for the multivariate models of training, posttraining, and overall attrition. Section VI summarizes the findings and discusses the policy implications of the analysis.

Three appendixes describe the statistical bases of the study. The 12 tables constituting Appendix A display the regression coefficients for the various attrition models. Appendix B details the tests for stability of coefficients, and Appendix C gives the regression results for the combined male-female two-year attrition model.

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<sup>1</sup>Recruits are classified into Category I, Category II, Category III, and Category IV mental groups, based on scores received on the entrance examination (Armed Forces Qualifying Test, or AFQT). Category I receive scores of 80 and above; Category IV receive scores of 30 and below.



## II. THEORETICAL FRAMEWORK FOR ANALYZING RESERVE ATTRITION

At the time of enlistment, the reservist and the reserve component enter into a contract. Presumably, each party considers the enlistment to be in its own best interest, based on a calculus of perceived costs and benefits. At the time of attrition, this calculus clearly has changed for at least one of the involved parties, who regards separation as the best course of action. The calculus might change either because one party is better able to evaluate costs and benefits of alternatives based on new information obtained after enlistment and/or because changed circumstances affect the relative attractiveness of the alternatives.

From the Army's point of view, the decision calculus includes the benefits of retaining the individual (contribution to unit readiness) versus the costs (wages and benefits and the costs of separating him). The costs of separation include the relative wages and productivity of replacement personnel, costs of obtaining replacement personnel, costs of having the position vacant for a time, and routine separation costs.

From the individual's point of view, the original enlistment calculus includes the benefits of reserve service (earnings over the period of service, training opportunities, and reserve benefits) versus the costs (the commitment to attend reserve drills and annual training, the possibility of mobilization, and the opportunity costs of forgone work and leisure time; the last includes forgone earnings from additional hours spent on a primary job or another moonlighting job or the forgone utility from additional leisure time).

The first step in explaining reserve attrition decisions requires identifying the changes that can tip the decision calculus for either the individual or the reserve component from an original enlistment decision to a separation decision. The second step is to estimate the frequency of these changes for different types of enlistees. The third step is to estimate the degree of sensitivity of separation to each change. While theoretically straightforward, the data to support such estimates do not currently exist.

In this section, we will indicate the broad categories of changes that could lead to a separation decision either by the individual or the service. Next, we will comment on the likelihood that such changes will take place and on the sensitivity of a separation decision if changes occur. Finally, we will describe the data available for the current

analysis and develop some hypotheses that can be tested with the available data.

We will focus here on two types of changes that might occur during the enlistment term and hypothetically lead to separation:

- Changes involving the accumulation of new information and its reevaluation by both the enlistee and the reserve component early in the term
- Changes involving major external circumstances of the individual's life, i.e., changes in marital status, primary employer, or geographic location.

The first type of change probably predominates during the training period, as information is acquired by both parties regarding the suitability of the match between the reserve job and the recruit. Once the initial adjustment period is over, the reason for separation is likely to shift to changes of the second type, where the actual decision environment changes.

## **NEW INFORMATION AND REEVALUATION AFTER ENLISTMENT**

The Army and the enlistee enter the initial contract with limited information about each other because of the costs of further search. As perceptions change, either about each other or about other alternatives, each may decide that an alternative other than reserve service offers greater utility. For the reserve components, the alternative is replacement with another individual; for the reservist, the alternative is another moonlighting job or not holding a moonlighting job.

The recent literature in labor market theory attempts to explain quitting behavior in terms of individual and firm uncertainty and imperfect information. Such models can be classified into two categories according to their characterization of the source of that uncertainty.

The first model of quitting behavior (Lippman and McCall, 1979), a search model, depicts the worker as selecting a job without completely sampling all alternatives because of either high sorting costs or incomplete information. New information on alternatives leads to a reappraisal of the job match. The second model, based on Nelson's (1970) approach to consumer behavior in product markets, assumes the existence of unobservable characteristics of the job that can be learned only through experience on the job. As Pencavel (1972) states, "the

taking on of a job for a trial period may be the optimum method for an individual to discover whether that employment suits him."

In these experience models, then, jobs have two classes of attributes: general (or search) characteristics, which can be observed directly or without actually consuming the "good," and specific (or experience) characteristics, which become evident only through actual experience. The acceptance of any job is conditional; if the jobholder finds the value of the experience attribute (about which he was imperfectly informed) below some critical level, he will quit.

These models can be easily extended to include job separations initiated by the employer (firings), by positing two types of employee attributes: screening attributes, which can be observed by the employer prior to employment, and performance attributes, observed by the employer only after the individual works on the job. The attrition process can then be viewed as the consequence of rational decisionmaking in which belated information regarding the various experience attributes of the moonlighting job and the performance attributes of the employee is received and reevaluated by both the worker and employer.

Critical levels exist for both the employee and the employer. Separation will occur if either employee performance on the moonlighting job does not exceed the critical performance level for the employer, or if the experience attributes of the moonlighting job do not exceed some threshold set by the employee.

Several aspects of holding a reserve job may be classified as experience attributes. The experience of a typical enlistee may encompass schooling and holding a part-time or full-time civilian job; it is unlikely to include a military job, a military environment, or a moonlighting job.

The experience attributes of military training can include being away from home, the regimentation and competition of military life, group living, intense physical conditioning, and even receiving a full-time paycheck. Similarly, the experience attributes of holding the reserve moonlighting job after training can include various aspects of the military job and on-the-job training, attitudes of fellow reservists, forgone leisure time with a family, and certain aspects of reserve compensation.

One aspect of reserve compensation that may be an experience attribute is the large difference between reserve gross and net pay. Although an average first-term reservist will receive approximately \$1500 annually in reserve pay after the completion of training, his net

annual income after taxes will amount to only about \$780.<sup>1</sup> The recruit is unlikely to know about this large difference at enlistment; it becomes obvious only during the first term. Moreover, taxes often are not withheld from reserve pay; the reservist may find owing disproportionately high taxes at tax time unpalatable.

Another experience attribute of the reserve job derives from the inherent difference between the reserve enlistment contract and the less restrictive nature of most other moonlighting jobs. Quitting a reserve job requires breaking a contract and, therefore, is not exactly identical to leaving another part-time job.

For the Army, several performance attributes cannot be observed or predicted accurately from pre-enlistment observation or testing. The Army uses the Armed Services Vocational Aptitude Battery (ASVAB) to predict cognitive trainability and physical examinations to screen for physical trainability. However, both entrance tests are imperfect; they cannot screen for the important dimension of psychological adjustment to the military environment.

To this point, we have used the simple model developed for separations from full-time jobs and applied it straightforwardly to moonlighting jobs. However, the model requires two extensions to make it applicable to moonlighting job separation.

First, moonlighters may quit their moonlighting jobs not only because of experience attributes on their moonlighting jobs, but also because of specific experience attributes on their full-time job which arise because of their moonlighting job. These experience attributes may include scheduling conflicts between the two jobs or lower performance and slower promotion on the primary job because of the moonlighting job. Thus, even though the enlistee performs well on the moonlighting job and the job meets the enlistee's criteria, he may separate because of conflicts with the full-time employer.

Participation in the reserve may cause schedule conflict because of the unusual reserve work schedule (16 hours per month, typically on a single weekend) and periods of full-time demand (annual training for two weeks during the summer and an initial period of training of at

<sup>1</sup>The difference between gross and net pay is large for reservists for three reasons. First, approximately 30 percent of a reservist's annual pay is earned at annual training, during two full-time weeks in the summer. During this period, most reservists do not receive civilian income; thus, reserve pay simply substitutes for civilian income and may not contribute to net annual income. Second, reserve pay will be taxed at a higher marginal tax rate than civilian income, further reducing the contribution to net income. Third, transportation costs to and from drills, although deductible later, must also be subtracted from income. Based on these factors, the average reservist's first-term net reserve income will amount to approximately 55 percent of gross reserve income. See Burright et al. (1982).

least three months). This work schedule makes the reservists particularly vulnerable to conflicts between reserve obligations and employers, who must provide leave or time off so that the reservist may fulfill full-time reserve obligations.

Schedule conflicts may be particularly difficult for young persons who have only recently adjusted to civilian full-time or part-time jobs. Conflicts with the civilian employer have been shown to be one of the two leading causes of reservists leaving at the end of their term (Burrigh et al., 1982). One would expect these tensions to appear also during the first term of service and cause attrition.

A second extension is needed to explain separation from the reserve to the active force. The normal theory posits that experience attributes of the reserve job that result in a lower taste for military service can cause attrition. However, another possibility exists. The reserve moonlighting job may *reinforce* the enlistee's taste for military life and he may quit his moonlighting job to seek a full-time job in this field. Hence, in the theory, an upper-level threshold must exist for the moonlighting job experience attributes which, if exceeded, initiate a job search for a full-time job in an occupation similar to the moonlighting job. Upon finding the new full-time job, the individual quits his moonlighting job.

Thus, reserve enlistment may be essentially a stepping-stone to active force enlistment. Survey data on reservists show that a strong motivation for joining the reserve rather than the active force is to try out military service.<sup>2</sup> Our current data show that over the first two years of reserve enlistment, 4 percent to 8 percent of a reserve cohort joins the active force.

### CHANGE IN MARITAL OR EMPLOYMENT STATUS OR RESIDENCE AFTER ENLISTMENT

The reservist decides to enlist on the basis of labor market information, marital status, and home at the time of enlistment. Presumably, major conflicts with employers or spouses that might have prevented enlistment do not exist or have been satisfactorily resolved.

During the six-year period of enlistment, the enlistee's marital status, employer, or place of residence will likely change. Any one of these changes will cause the individual to reevaluate his commitment to the reserve job in light of his new circumstances. The likelihood of separation will depend on (1) the probability of these changes occurring

<sup>2</sup>Unpublished printouts from the 1979 Reserve Forces Study. For a description of the survey, see Doering et al. (1981a). See also Doering et al. (1981b) and Hawes (1981).

and (2) the probability that a given change will actually lead to separation. Some data have been collected on the incidence of major changes in marital status, employment status, and residence location among various demographic groups.

### Marital Status

Although approximately 85 percent of nonprior-service enlistees are single when they enlist, many will marry before the end of term of enlistment. Table 1 shows the probability of a first marriage for young male and female Americans by age group and race. Approximately 24 percent of white males and 33 percent of white females marry between the ages of 20 and 24. These first marriage rates increase for ages 25 to 29 for white and black males and black females. However, for white females, marriage rates decline for the 25 to 29 age group. Blacks have a somewhat lower marriage rate, with males and females following a similar pattern.

Table 1

PROBABILITY OF FIRST MARRIAGE,  
BY SEX, AGE, AND RACE

Sex and Age	White	Black
<b>Males</b>		
18 to 19 years	5.8	1.3
20 to 24 years	24.1	14.4
25 to 29 years	36.0	34.0
<b>Females</b>		
18 to 19 years	16.9	4.0
20 to 24 years	32.6	24.5
25 to 29 years	29.9	30.9

SOURCE: "Marital Status and Living Arrangements, March 1982," *Current Population Reports*, Series P-20, No. 380, Bureau of the Census.

If, as seems reasonable, a higher probability of a change in marital status is associated with a higher probability of separation, then these data allow us to formulate several *ceteris paribus* hypotheses:

- Older male enlistees are likely to have higher attrition rates than younger male enlistees.
- Women are likely to have higher attrition rates than men.
- Whites are likely to have higher attrition rates than blacks.

### Employment

We have no direct evidence on the probability of job change by sex, age, or race. If, as seems likely, job separation leads to job search and the acceptance of another full-time job, then separation rates from full-time jobs would be a reasonable proxy for this variable. Table 2 shows clearly the large difference in separation rates from full-time jobs between 18- to 24-year olds and 25- to 44-year olds. Males and females differ surprisingly little, but blacks have lower separation rates than whites. Overall, separation rates decrease with age.

Higher separation rates may well be associated with higher attrition from the reserve if (1) the new job causes previously resolved conflicts to resurface or (2) if the new job requires relocation. Alternatively, the uncertainties and tensions inherent in any new employment may

Table 2  
SEPARATION RATES FROM FULL-TIME JOB,  
BY SEX, AGE, AND RACE

Sex and Age	White	Black
Male		
18 to 24 years	37.5	27.4
25 to 44 years	15.9	13.4
Females		
18 to 24 years	34.7	26.1
25 to 44 years	17.7	9.7

SOURCE: *Monthly Labor Review*, June 1983, Vol. 106, No. 6, Bureau of Labor Statistics.

themselves cause attrition even without any direct or expressed employer conflict. If job separation rates are important determinants of reserve attrition, then, other things equal,

- Older individuals will have lower attrition than younger ones.
- Blacks will have lower attrition than whites.

### Geographic Mobility

The primary reasons for moving are economic—either to seek employment if unemployed or to move to better jobs if currently employed. Those having greater location-specific capital—years of experience on current job, local family ties, and home ownership—will move less frequently. Those who move once are more likely than nonmovers to move again, often back to the original home.

The propensity to move varies in well-known ways for the general population.<sup>3</sup> Migration rates peak among individuals in their early twenties and decline with age. Blacks migrate less frequently than whites. Individuals with higher educational attainment migrate more often than those with lower educational attainment. Migration is also closely linked to marriage and family formation, with the first few years after marriage being a period of frequent moves. Since women marry at younger ages than men and more frequently move to the geographic location of the spouse, mobility rates among women are likely to be higher than those among men.

Table 3 presents data on the percentage, by age and sex, of high school graduates not in college moving to a different household in 1982-1983. Those between the ages of 18 and 29 moved frequently. Approximately 30 percent of those 18 to 24 and not in college—the prime enlistment group—changed households.

These rates may overestimate the mobility of *reservists* for two reasons. The count includes individuals who enlist in the active force and for whom migration would be mandatory. Second, they do not take account of the fact that joining a reserve unit involves self-selection—probably of people who have no immediate plans to move and people for whom reserve membership increases their location-specific capital.

In the younger age group, as shown in Table 3, females moved more frequently than males. For the older age group, males and females moved at approximately equal rates. Older individuals moved less frequently than younger individuals regardless of sex.

<sup>3</sup>For reviews of migration determinants, see Morrison (1971) and DaVanzo and Morrison (1982).



Table 3

PERCENTAGE OF HIGH SCHOOL GRADUATES  
NOT IN COLLEGE MOVING TO ANOTHER  
HOUSEHOLD, MARCH 1982-MARCH 1983

Age	Male	Female
18 to 24 years	28.3	32.3
25 to 29 years	26.9	24.5

SOURCE: "Geographical Mobility:  
March 1982 to March 1983," *Current  
Population Reports*, Series P-20,  
No. 393, Bureau of the Census.

Many moves to different households may involve short distances and therefore would not affect the distance to a reserve unit. More serious from the reserve viewpoint would be moves out of county. Table 4 displays data similar to those in Table 3 for longer moves. The same patterns appear to hold, except that younger men and

Table 4

PERCENTAGE OF HIGH SCHOOL GRADUATES  
NOT IN COLLEGE MOVING TO ANOTHER  
COUNTY, MARCH 1982-MARCH 1983

Age	Male	Female
18 to 24 years	11.4	11.6
25 to 29 years	10.0	8.6

SOURCE: "Geographical Mobility:  
March 1982 to March 1983," *Current  
Population Reports*, Series P-20,  
No. 393, Bureau of the Census.

women no longer differed. However, if the male count included a larger fraction of active force enlistees for whom out-of-county migration was mandatory, and if one could adjust for this, the adjusted rates would presumably show both male-female differences and age differences similar to those in Table 3.

Similar breakdowns of mobility rates by race are not available; however, Table 5 shows migration to another standard metropolitan statistical area (SMSA) by race. The expected pattern of lower migration among blacks is evident. If migration affects reserve attrition, then the following testable hypotheses emerge:

- Females will have higher attrition than males for the 18-to-24 age group.
- Blacks will have lower attrition than whites.
- Older enlistees will have lower attrition than younger enlistees.

Table 5  
PERCENTAGE OF HIGH SCHOOL GRADUATES NOT  
IN COLLEGE MOVING TO ANOTHER SMSA  
MARCH 1982-MARCH 1983

Age	White	Black
15 to 24 years	13.8	8.5
25 to 34 years	12.7	9.0

SOURCE: "Geographical Mobility:  
March 1982 to March 1983," *Current  
Population Reports*, Series P-20,  
No. 393, Bureau of the Census.

## SUMMARY

The theoretical framework outlined above highlights the fact that the attrition decision depends crucially on three factors:

- The informed nature of the original enlistment decision
- The probability of meeting the training standards
- The probability of changes in employment, residence, or household composition after enlistment.

These are in turn determined by the social, demographic, and economic characteristics of the reservist and the institutional policies of each component.

Our theoretical framework does not translate easily into a set of unambiguous hypotheses that can be tested with our data. The two major strands of our theory—accumulation and reevaluation of belated information and changes in environment—predict contrary effects of some variables on attrition, as discussed below.

- *The effect of age on overall attrition is indeterminate.*

Other things being equal, older reservists should be more likely to stay, having made presumably more mature decisions in the first place, based on an informed job-search process and a thorough evaluation of job and family demands. Weighing against this to some extent is the fact that civilian income is presumably higher for older individuals; economic theory would, therefore, predict that their demand for leisure would increase. Again, particularly during the training period, the physical rigors of training may well favor younger reservists. Also, the chances of marriage increases for males 25 to 29 over those 20 to 24, but decreases slightly for females. Geographical mobility appears to decrease for the older group. These influences would tend to work in opposing directions for males and the same direction for females. Hence, we would expect some asymmetry in the models for male and female attrition.

- *Blacks should have a lower attrition rate than nonblacks.*

Other things equal, blacks exhibit a lower likelihood of geographical moves or job changes and less chance of early marriage, all of which would predict lower attrition.

- *Women should have higher attrition rates than men.*

Other things equal, women may be less likely to meet physical training standards and more likely to marry and/or move during the prime enlistment years. In addition, spouse conflict will be more likely to arise for women than for men, owing to their traditional role in the family. Childbearing and rearing may also increase the separation rate for women. Thus, women are expected to have higher attrition rates than men.

- *Higher educational attainment and AFQT scores should bring lower attrition.*

Better educated individuals and those with higher AFQT scores will more likely make sound enlistment decisions and meet training—especially advanced training—standards. Few data are readily available to determine the differences in marriage rates and job separation rates by education. Some evidence indicates that in the general youth population better educated people move more often. However, we have no data to suggest that this holds true for high school graduates versus nongraduates. If we assume no differences, attrition will be lower for individuals with more education and higher AFQT.

Finally, the commitment to the reserve job and term of service takes place during a stage of life when important commitments are being made, changed, and reformed. Initial labor market entry and attachment and early career development often involve trying different full-time jobs. During this stage of life, marriage and family formation often necessitate moves to different housing or moves based on improving economic well-being. In this environment, the traditional emphasis on recruiting individuals with high chances of completing training may need tempering with characteristics contributing to stability of life situations. Careful analysis of attrition data can help to determine the relative emphasis between trainability and stability of life situations.

### III. PATTERN OF ATTRITION IN FY1980 COHORT

We chose the FY1980 cohort for analysis because we could obtain much better personnel data on this group than on earlier cohorts; moreover, the data could provide at least two years of *recent* attrition history. In particular, earlier cohort data could not distinguish between high school dropouts and seniors who had not yet graduated from high school. Many youths join the reserve during their senior year and enter training after completion of high school. In earlier cohorts, these individuals were classified with high school dropouts.

This section presents a profile of the 1980 Army National Guard and Army Reserve nonprior-service cohort and their attrition patterns over time and loss categories. In analyzing the data, we found marked differences in the characteristics of men and women enlistees and in their level and pattern of attrition. The last subsection, therefore, presents the demographic composition of the male and female FY1980 cohorts and basic attrition statistics for the two groups.

#### DATA BASE

The primary data source for reserve personnel information is the Reserve Components Common Personnel Data System (RCCPDS), maintained by the Defense Manpower Data Center (DMDC). Begun in March 1973, the RCCPDS became the official source for reserve force inventory figures in July 1974.

The DMDC has developed cohort files encompassing several fiscal years. Although these files include all six reserve components, we use only extracts for the Army Reserve and the Army National Guard, which together account for approximately 85 percent of all nonprior-service accessions in the selected reserves.

The DMDC cohort file for each fiscal year contains the enlistment records, subsequent master file records, and loss records for all individuals who were identified as gains during that fiscal year. The files have been updated to reflect the information available on any particular reservist through September 1982. For the FY1980 cohort, this file allows us to examine attrition during the first two years. In addition, for those who separated, the active and reserve master file was searched from the date of separation through FY1982. If a former

reservist joined the active force or rejoined the reserve, the enlistment record was added to the file.

## **DEMOGRAPHIC PROFILE OF ARMY NATIONAL GUARD AND ARMY RESERVE FY1980 COHORT**

The FY1980 nonprior-service accession cohort (see Table 6) typifies reserve accession cohorts since the end of the draft. The typical enlistee is a single, white male, 18 to 20 years old, who graduated from high school and scored in the 31st to 64th percentile on the ASVAB test. However, the cohort contains a sizable fraction of women, blacks, high school nongraduates, and individuals with both significantly higher- and lower-than-average mental categories. Over one-fourth of the enlistees are 17 years old; another one-fourth are between 20 and 35 years old. This diverse demographic mix of enlistees, combined with a large total sample size, provides an ideal universe in which to study patterns of attrition behavior.

Several interesting differences emerge between the Army National Guard and Army Reserve recruits. Some of these differences stem simply from size and mission: The Guard had 408,000 members in FY1982 and the Reserve, 257,000; Guard missions involve predominantly combat and Reserve missions mainly combat support.

The Army National Guard recruits almost twice the number of nonprior-service reservists as the Army Reserve. The proportion of women in the Guard is relatively small, owing primarily to the large demand for combat personnel and the current exclusion of women from combat. The Army Reserve recruits a higher proportion of blacks and a somewhat higher proportion of recruits over 20 years old. Break-downs by marital status show fairly similar distributions for both components. The Army Reserve also appears to have a somewhat higher proportion of lower-quality accessions (defined as high school nongraduates and those scoring in Category IV on the AFQT).

## **RATES AND TIMING OF ATTRITION**

Attrition in the reserves can be categorized as being either programmed or unprogrammed. Most reservists sign up for a six-year term of service, although three-year terms have also been available. Programmed losses occur at the end of the enlistment term; unprogrammed losses occur before completion of the committed term. Since we have only two full years of history for the cohort, all losses are unprogrammed.

Table 6  
 DEMOGRAPHIC COMPOSITION OF ARMY NATIONAL  
 GUARD AND ARMY RESERVE FY1980  
 NONPRIOR-SERVICE COHORT  
 (In percentages)

Variable	National Guard	Army Reserve
Sex		
Male	90.4	67.7
Female	9.6	32.3
Race		
Black	20.3	31.0
Nonblack	79.7	69.0
Age at enlistment		
Less than 18 years	27.3	24.5
18 to 20 years	51.2	48.2
21 years or older	21.5	27.3
Marital status		
Single, no dependents	85.2	86.4
Single, with dependents	4.1	0.8
Married, no dependents <sup>a</sup>	4.5	5.1
Married, with dependents	6.2	7.7
Education		
High school nongraduate	31.8	46.7
High school graduate	68.2	53.3
AFQT score <sup>b</sup>		
Category I	2.9	2.8
Category II	18.5	18.1
Category III	68.1	62.4
Category IV	10.5	16.7
(N)	48,823	24,908

<sup>a</sup> A spouse is not considered a dependent.

<sup>b</sup> AFQT scores have not been renormed.

Our computerized records can distinguish between losses who later join the active force or return to a selected reserve component and losses to the Individual Ready Reserve (IRR) or to civilian life. In this report, we will combine losses who return to service into one category and losses who return to civilian life or the IRR into a second category.

A loss to the active force may, in fact, bring more return on training investment than reserve service, and planners may consider such a transfer as an asset to the total force. A loss to another selected reserve component brings more return on training investment than a loss to civilian life but less than retention by the original component, since retraining would ordinarily be required in a new unit. A loss to the IRR remains liable for call-up during mobilization but otherwise has no training obligation and is not paid.

The Army National Guard lost 30.6 percent of the 1980 cohort (see Table 7) to all loss categories during the first two years after enlistment, while the Army Reserve lost 39.5 percent. The timing of the losses is strikingly dissimilar in the two services. The Army National Guard has higher training attrition and lower posttraining attrition than the Reserve. The different pattern may reflect the different training and screening procedures used for combat versus noncombat skills. It may also reflect different training standards.

Table 7  
TWO-YEAR ATTRITION RATES OF ARMY NATIONAL GUARD  
AND ARMY RESERVE FY 1980 NONPRIOR-SERVICE  
COHORT, BY TIMING OF LOSS  
(In percentages)

Timing of Loss	National Guard	Army Reserve
Pretraining and training	18.8	8.9
1st year after training	1.9	10.8
2d year after training	9.9	19.8
Total	30.6	39.5
Remaining after 2 years	69.4	60.5



Overall attrition to civilian life (see Table 8) is somewhat higher for the Army Reserve (28.3 percent) than for the Army National Guard (25.4 percent). The attrition patterns differ in that a significant portion of the Army Reserve posttraining losses return to reserve components or the active force, whereas a much smaller percentage of the Army National Guard losses return. Army reservists may enter the active force at higher rates, since they are originally recruited by recruiters who enlist both active and reserve personnel. These recruiters may simply continue to recruit reservists for the active force after they enlist in the reserve. Transfer may be relatively easy, since the reserve and active processing are similar. Guardsmen may find

Table 8

TWO-YEAR ATTRITION RATES OF ARMY NATIONAL GUARD AND  
ARMY RESERVE FY1980 NONPRIOR-SERVICE COHORT,  
BY TIMING AND DESTINATION OF LOSS  
(In percentages)

Destination of Loss	Timing of Loss		
	Pre- training, Training	Post- training	Total
Army National Guard			
Civilian life	17.8	7.6	25.4
Selected reserves	0.3	0.8	1.1
Active force	0.7	3.4	4.1
Total	18.8	11.8	30.6
Army Reserve			
Civilian life	7.4	20.9	28.3
Selected reserves	0.7	2.9	3.6
Active force	0.8	6.8	7.6
Total	8.9	30.6	39.5

more barriers to active enlistment. To join the active force, a guardsman would have to take the initiative in contacting an active force recruiter and would have to undergo partial reprocessing (including ASVAB tests), since the Guard and active enlistment processing systems differ somewhat.

We may be underestimating the number of those returning, since we searched active and reserve records only up to two years past enlistment. Some reservists may return later. Further work needs to be done to determine the timing of return.

### **DIFFERENCES IN DEMOGRAPHIC COMPOSITION AND ATTRITION PATTERNS, BY SEX**

We had hypothesized earlier that women were likely to have higher attrition than men and that the patterns of attrition may differ because of differing marriage and migration patterns. Subsequent analysis substantiated this hypothesis. The demographic composition of the male and female cohorts, their level of attrition, and as we shall see later, even the variables that appeared to influence attrition behavior differ.

Two-year attrition rates differ strikingly between males and females, as Table 9 makes evident. For both the Army National Guard and Army Reserve, approximately 46 percent of women leave prior to the completion of two years of service, in contrast to approximately 29 percent of men in the Army National Guard and 37 percent in the Army Reserve. The different pattern between the two components in the timing of attrition holds for both men and women.

Our theory had suggested several possible reasons for women having higher attrition rates than men: the greater likelihood of marriage and attendant geographic moves, childbearing, and the higher probability of spousal conflict. The training attrition rates for men and women in the Guard differ most. We can advance some possible explanations, but we have no supporting data. Although the basic training for both components is identical, the advanced individual training (AIT) varies. If the AIT in the Guard is physically more rigorous or if it includes nontraditional specialties, women may find it harder to complete the training successfully.

Differences in enlistment quality cannot explain the differences in attrition rates between men and women. Table 10 describes the two cohorts in terms of demographic and aptitude characteristics. Females have a much higher proportion of high school graduates and those scoring high in the AFQT. Female accessions also have a higher pro-

Table 9  
 TWO-YEAR ATTRITION RATES OF ARMY NATIONAL GUARD AND  
 ARMY RESERVE FY1980 NONPRIOR-SERVICE COHORT,  
 BY TIMING OF LOSS AND SEX  
 (In percentages)

Sex	Timing of Loss		Total
	Pre-training, Training	Post-training	
Army National Guard			
Male	17.3	11.6	28.9
Female	33.1	13.5	46.6
Army Reserve			
Male	7.8	28.9	36.7
Female	10.9	34.2	45.1

portion of blacks and appear to be somewhat older than their male counterparts. Previous studies of active force attrition (for example, Buddin, 1981 and 1984) have shown that higher educational attainment and aptitude usually lead to lower attrition. If active and reserve patterns are similar, women in the reserve should have lower attrition than men, given their generally higher level of education and AFQT scores. The multivariate models of attrition presented in the next sections address these questions more precisely.

Table 10  
 DEMOGRAPHIC COMPOSITION OF ARMY NATIONAL GUARD AND  
 ARMY RESERVE FY1980 NONPRIOR-SERVICE COHORT  
 (In percentages)

Variable	National Guard		Army Reserve	
	Male	Female	Male	Female
Race				
Black	19.5	29.8	28.0	37.2
Nonblack	80.5	70.2	72.0	62.8
Age at enlistment				
Less than 18 years	28.1	19.1	28.3	16.5
18 to 20 years	52.0	44.1	50.0	44.7
21 years or older	19.9	36.8	21.7	38.8
Marital status				
Single, no dependents	85.3	84.2	88.8	81.3
Single, with dependents	4.1	3.8	1.0	0.2
Married, no dependents	4.3	6.3	3.7	8.2
Married, with dependents	6.3	5.7	6.5	10.3
Education				
High school nongraduate	33.3	17.2	52.9	33.7
High school graduate	66.7	82.8	47.1	66.3
AFQT scores <sup>a</sup>				
Category I	2.5	6.4	2.5	3.4
Category II	17.5	25.7	13.9	26.8
Category III	69.2	61.7	64.9	57.5
Category IV	10.8	6.2	18.7	12.3
(N)	44,170	4,651	16,845	8,061

<sup>a</sup>AFQT scores have not been renormed.

## IV. A MULTIVARIATE ANALYSIS OF TWO-YEAR ATTRITION

This section develops a multivariate attrition model to assess the importance of the variables hypothesized above to influence attrition. From the standpoint of setting recruit standards, the multivariate model can be used to estimate the probability of attrition for individuals with specific characteristics and, thus, to determine screening criteria that could be used to minimize attrition.

### EMPIRICAL MODEL

Empirically, the attrition process is summarized by a dichotomous dependent variable that categorizes individuals as stayers or leavers. The outcome variable is defined as:

$$Y_{it} = \begin{cases} 0, & \text{if individual } i \text{ stayed through time period } t \text{ and} \\ 1, & \text{if individual } i \text{ separated during time period } t. \end{cases}$$

Models were estimated for three time periods: (1)  $t = 1$ , pretraining and training period; (2)  $t = 2$ , posttraining period extending from the end of training to two years from date of enlistment; and (3)  $t = 1+2$ , first two years from date of enlistment combining the two time periods. Thus, for the  $i^{\text{th}}$  individual, three separate outcome variables were defined as being 0 or 1, depending on whether the reservist stayed or left during the given period. Of course, any individual who separated during the pretraining and training period was clearly not faced with the choice of staying or leaving during the posttraining period. Such individuals were automatically excluded from the posttraining attrition model.

The conditional logistic regression (logit) model is an appropriate choice for the functional form, since it restricts the value of the dependent variable to zero and one. This model relates the separation decision of the  $i^{\text{th}}$  individual,  $Y_i$ , to a vector of characteristics for that individual,  $x_i$ . The assumed relationship is:

$$Y_i = p(x_i) + \varepsilon_i,$$

where

$$p(x_i) = P[Y_i = 1|x_i] \\ = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik})}}$$

$k$  denotes the number of characteristics measured for each individual, and  $\beta_0, \beta_1, \dots, \beta_k$  are the parameters of the model to be estimated.

Two estimation methods are commonly used to estimate the parameters in studies of this type: conditional maximum likelihood estimation and discriminant function analysis. Since several empirical studies report similar estimates with both methods,<sup>1</sup> we chose the cheaper, discriminant function method.<sup>2</sup>

Before discussing the empirical results obtained by fitting this model to data from the FY1980 cohort, we must mention two caveats. Clearly, the nature of the primary job and employer attitudes may affect a recruit's decision to stay or separate. Unfortunately, neither of these variables was available. Second, few data are available describing service-related experiences (*experience* attributes), which also may affect early attrition. In earlier research, an attempt to include assigned training specialty as a proxy (admittedly a poor one) had to be abandoned as the variable was highly collinear with some demographic and aptitude variables. We therefore have not included it in this analysis. Data on civilian jobs and service experience collected through surveys would prove invaluable in analyzing attrition.

In estimating our models, we adopted two definitions of attrition. The first, broader definition includes losses to civilian life, other components, or the active force. The second, narrower definition includes only losses to civilian life. The first definition represents the viewpoint of the component; the second, the total force.

<sup>1</sup>See Haggstrom (1983); Chow and Polich (1980); Halperin et al. (1971).

<sup>2</sup>The linear discriminant specification of a logistic attrition model is  $\ln[P(Y_i)/(1 - P(Y_i))] = x\beta$ ; i.e., the natural logarithm of the odds ratio is a linear function of  $x$ . The estimated coefficients are derived by rescaling the ordinary least squares (OLS) coefficients relating  $Y$  and  $x$ . In other words, one simply computes a linear probability function by regressing  $Y_i$  on  $x_i$ , using OLS. Then one can obtain the discriminant function estimates  $\alpha$  and  $\beta$  as:  $\beta = (n/SSE) * \hat{\beta}$  and  $\alpha = \log(P_1/P_2) + [(n/SSE)(\alpha - 0.5)] + [n(n_1^{-1} - n_2^{-1})/2]$  where  $\alpha, \beta$  = the OLS intercept and estimated coefficient;  $n$  = number of observations;  $SSE$  = residual sum of squares from the OLS regression;  $n_1$  = number of observations for which the dependent variable has the value 1;  $n_2 = n - n_1$ ;  $P_1$  = proportion of individuals in the target population for which  $Y$  has the value 1. (If observations are drawn at random from the target population, one can estimate  $P_1$  using  $n_1/n$ , and  $P_2 = 1 - P_1$ .)

The component considers the attrition of trained, productive individuals to other segments of the total force undesirable, since it represents a loss of training investment and probably lowers the readiness of the component. The total force viewpoint prefers transfers between components to civilian attrition, since not all returns to training are lost and, in the case of transfer to the active force, the returns to training may increase.

The extent of recoupment or enhancement of training investment depends critically on whether individuals need specialty retraining upon transfer. Retraining is probably required more often in transfers between reserve components, since the individual will be limited to the selection of specialties from local units. The chances of finding a vacancy to match the existing specialty will be much greater in the active force.

We first present results from the two-year attrition model, by sex, for each component, looking at civilian losses as well as all losses. Section V analyzes attrition prior to the completion of training and post-training attrition separately. The timing-of-attrition model is also presented for males and females separately.

## EMPIRICAL RESULTS

Table 11 defines the dependent variables used in the empirical models. The independent variables are dichotomous, equal to one if the individual has the defining characteristic, zero otherwise. Since discriminant function regression coefficients have no easy interpretation, the results are transformed and presented as attrition probabilities. These probabilities, calculated from the regression coefficients as:

$$P(x_i) = \frac{1}{1 + e^{-(a + \sum_j b_j x_{ij})}}$$

where  $P(x_i)$  = probability of attrition of a specific reservist  $i$

$x_{ij}$  = values of the explanatory variable  $j$  for reservist  $i$

$b_j$  = estimated coefficients for the  $x_j$ ,

represent a convenient and useful summary of the regression model effects. The actual regression coefficients are given in Appendix A.

Table 11

## DEFINITION OF DEPENDENT VARIABLES IN ATTRITION MODELS

Variable	Definition
All Losses	
TRATT	Reservist separated before or during training
POSTATT	Reservist separated after training and within 2 years of enlistment
ATTRIT	Reservist separated within 2 years of enlistment
Losses to Civilian Life or IRR	
TRATTCIV	Reservist separated before or during training, either to civilian life or Individual Ready Reserve (IRR)
POSTATTCIV	Reservist separated after training and within 2 years of enlistment, to civilian life or IRR
ATTRITCIV	Reservist separated within 2 years of enlistment, to civilian life or IRR

### Need for Separate Attrition Models for Males and Females

We present models of attrition for males and females separately. Extensive preliminary analysis showed the importance of several interaction terms (predominantly those containing the variable sex or race) in explaining attrition. Our theoretical framework gave some credence to the hypothesis that men and women would have markedly different attrition patterns, given such probabilistic factors as early



marriage and childbearing, spousal conflict, migration, and physical ability. This theoretical difference and the fact that males and females showed far greater differences in attrition than blacks versus nonblacks led us to analyze only males and females separately.

We used two methods to test the validity of our assumption that models for males and females have different regression coefficients. One is based on the Chow test of equality between sets of coefficients, described in Appendix B. The other uses the pooled sample to examine in detail *which* coefficients are statistically different by allowing different coefficients for the two groups.<sup>3</sup> The results of this test are also described in Appendix B.

The regression results for combined male and female groups are given in Appendix C. They illustrate why a separate analysis of male and female attrition is required, and they also present attrition rate estimates that can be used for the entire cohort.

### Two-Year Attrition: Males and Females

Table 12 presents estimation results of the two-year attrition model for males and females. The table entries are estimated attrition probabilities for an individual with the designated characteristics. In this and subsequent tables, a reference individual is defined and the attrition probability calculated for that individual. Attrition probabilities are then calculated for an individual who differs from that reference individual in one characteristic, holding all others constant at the reference category values.

The first column of Table 12 gives the attrition probabilities for male guardsmen. The attrition probability is .18 for the reference individual who is a single, nonblack, high school graduate, 18 to 20 years old, and in Category III. If that individual were black instead of non-black, but had all the other characteristics, the attrition probability would be .23.

We will focus first on the results for males in the National Guard. Our reference individual has a two-year attrition rate of 18 percent. Ignoring interaction terms, the largest difference in attrition occurs between high school graduates (18 percent) and nongraduates (31 percent). Statistically significant and large differences also occur in attrition rates among different mental categories (12 percent for Category I, 25 percent for Category IV). Blacks have a higher attrition rate (23 percent) than nonblacks (18 percent).

<sup>3</sup>See DaVanzo and Habicht (1984) for an example of this technique.

Table 12

**TWO-YEAR RESERVE ATTRITION PROBABILITIES: LOSSES TO CIVILIAN  
LIFE, BY COMPONENT, SEX, AND RESERVIST CHARACTERISTIC**  
(Dependent Variable: ATTRITCIV)

Characteristic	National Guard		Army Reserve	
	Male	Female	Male	Female
<i>Average attrition probability<sup>a</sup></i>	.18	.44	.19	.35
Race				
<i>Nonblack</i>	.18	.44	.19	.35
Black	.23*	.36*	.22*	.27*
Education				
<i>High school graduate</i>	.18	.44	.19	.35
High school nongraduate	.31*	.62*	.31*	.48*
Age				
Less than 18 years	.15*	.34*	.16*	.36
18 to 20 years	.18	.44	.19	.35
21 years or older	.25*	.41	.21*	.33
Family status				
Single, no dependents	.18	.44	.19	.35
Single, with dependents	.18	.47	.18	.36
Married, no dependents	.21*	.51*	.19	.38
Married, with dependent	.19	.51*	.18	.35
AFQT				
Category I	.12*	.27*	.13*	.25*
Category II	.14*	.38*	.16*	.31*
<i>Category III</i>	.18	.44	.19	.35
Category IV	.25*	.51	.22*	.36
Interactions				
Black, high school nongraduate	.35*	.52	.33	.41
Black, less than 18 years old	.18	.33	.19	.26
Black, 21 years or older	.28	.31	.22*	.22

NOTE: Tables A.1 and A.2 present the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, high school graduate, 18 to 20 years old, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.

Age is also statistically significant, with attrition increasing to 25 percent for those over 20 years of age. The presence of dependents at enlistment makes no significant difference in attrition for males, although being married shows a statistically significant increase in attrition. Among interaction terms tested, high school nongraduates who are black have a significantly higher attrition rate (35 percent) than high school nongraduates who are not black (31 percent).

Turning to the females in the National Guard, we see some similarities to and some major differences from the male results. First, the attrition rate for our reference female is 44 percent—more than twice the 18 percent rate for a male with the same characteristics. However, the direction of the effects of education and mental category are similar for males and females.

Holding other characteristics constant, female high school nongraduates have a significantly higher probability of attrition than female graduates: 62 percent versus 44 percent. Category I females have a much lower attrition rate (27 percent) than Category IV (51 percent). Marital status for women, unlike for men, seems to make a marked difference, with increased attrition for those who are married.

Race has a major effect and age a lesser effect on the differences in attrition probability between men and women. Black males, for example, have higher attrition (23 percent) than white males (18 percent), but black females have significantly lower attrition (36 percent) than white women (44 percent). The effects of age also seem to differ for men and women. Raising our reference age from 18-to-20 to 21-and-over increases attrition in men and lowers attrition in women.

Army Reserve males are markedly similar to National Guard males. The attrition rates for the reference individuals are 18 percent for guardsmen and 19 percent for reservists. The education and mental category variables are equally significant for guardsmen and reservists. Marital status appears to have no real effects. Like guardsmen, young reservists (17 years) have a lower attrition rate than older ones, while older reservists have a higher attrition rate than the reference group.

A comparison of the results for women in the two components shows a much lower attrition rate for women with the same reference characteristics in the Army Reserve (35 percent) than in the National Guard (44 percent). The effects of mental category are also important in the Reserve, as they are in the Guard.

To summarize, other things equal, women have markedly higher attrition rates in both the Guard and Reserve than do men. This was to some extent predicted by our theory. We had shown that women tend to have a much higher probability of change in marital status and location; we had also hypothesized that they may face a greater likeli-

hood of spousal conflict. The pattern of attrition between women and men shows both similarity and major differences. Education and mental category for both sexes are important determinants of attrition behavior, and the direction of effect is as hypothesized earlier.

The major difference between male and female attrition patterns is the effect of race. Other things equal, black women have lower attrition than nonblack women, while black men have higher attrition than nonblack men. This pattern is present in both components. Another, somewhat less significant difference is that, other things equal, women over 20 have lower attrition than 18- to 20-year olds, while men over 20 have higher attrition than 18- to 20-year olds. The effects of marital status and dependents are significant only in the Guard; as predicted, those who are married tend to have higher attrition than single guardsmen.

When the analysis includes losses to the active force and other reserve components as well as to civilian life, slightly different patterns emerge. The results (see Table 13) show that the Guard attrition patterns change little by including these additional losses, although the marital status variables are no longer significant for females. The major change is the increased loss rate for reference males from 18 percent to 23 percent, and for reference females from 44 percent to 50 percent.

For the Army Reserve, the loss rate for the male reference group increases from 19 percent for civilian losses to 29 percent for all losses. For the female reference group, the attrition rate increases from 35 percent to 48 percent. The Reserve loses more individuals to the active force and other components than does the Guard. Our reference enlistees (both male and female) in the Army Reserve are twice as likely to join the active or other reserve forces than are reference enlistees in the Guard.

An important question in distinguishing losses to civilian life and IRR from losses to active or other reserve components centers on the relative quality of these losses. We modeled the destination of loss decision among all losses as a nested decision process: (1) comparing civilian losses to those joining active or reserve forces and (2) comparing those who joined the active force to those joining the reserve. For this analysis we have included male and female enlistees together. Tables 14 and 15 present the estimated results.

Table 14 shows clearly that those lost to civilian life tend to be female, high school nongraduates, older, and in a lower mental category. Those who enlist in the active force or return to a reserve component are generally of higher quality than those who are lost to civilian life.

Table 13

TWO-YEAR RESERVE ATTRITION PROBABILITIES: ALL LOSSES,  
BY COMPONENT, SEX, AND RESERVIST CHARACTERISTIC  
(Dependent Variable: ATTRIT)

Characteristic	National Guard		Army Reserve	
	Male	Female	Male	Female
<i>Average attrition probability<sup>a</sup></i>	.23	.50	.29	.48
Race				
<i>Nonblack</i>	.23	.50	.29	.48
Black	.29*	.44*	.37*	.40*
Education				
<i>High school graduate</i>	.23	.50	.29	.48
High school nongraduate	.35*	.64*	.42*	.60*
Age				
Less than 18 years	.21*	.42*	.28	.47
18 to 20 years	.23	.50	.29	.48
21 years or older	.29*	.47	.30	.42*
Family status				
Single, no dependents	.23	.50	.29	.48
Single, with dependents	.23	.53	.28	.49
Married, no dependents	.25*	.56	.32	.54*
Married, with dependents	.24	.55	.29	.48
AFQT				
Category I	.18*	.35*	.24*	.34*
Category II	.21*	.46*	.27*	.44*
Category III	.23	.50	.29	.48
Category IV	.29*	.56	.31	.48
Interactions				
Black, high school nongraduate	.38*	.58	.43*	.51
Black, less than 18 years old	.27	.40	.35	.36
Black, 21 years or older	.34	.37	.33*	.31

NOTE: Tables A.3 and A.4 present the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, high school graduate, 18 to 20 years old, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.

Table 14

TWO-YEAR PROBABILITY OF RESERVE ATTRITION TO CIVILIAN LIFE  
AMONG ALL LOSSES, BY COMPONENT AND RESERVIST CHARACTERISTIC  
(Dependent Variable: ATTRITCIV)

Characteristic	National Guard	Army Reserve
<i>Average attrition probability<sup>a</sup></i>	.81	.64
Race		
<i>Nonblack</i>	.81	.64
Black	.81	.60*
Sex		
<i>Male</i>	.81	.64
Female	.89*	.75*
Education		
<i>High school graduate</i>	.81	.64
High school nongraduate	.91*	.75*
Age		
Less than 18 years	.71*	.53*
18 to 20 years	.81	.64
21 years or older	.87*	.73*
Family status		
<i>Single, no dependents</i>	.81	.64
Single, with dependents	.84*	.63
Married, no dependents	.84*	.61
Married, with dependents	.82	.64
AFQT		
Category I	.62*	.54*
Category II	.66*	.59*
<i>Category III</i>	.81	.64
Category IV	.86*	.70*
Interactions		
Black, high school nongraduate	.91	.77*
Black, less than 18 years old	.68	.52
Black, 21 years or older	.86	.66
Female, high school nongraduate	.94	.79*
Female, less than 18 years old	.87	.77*
Female, 21 years or older	.90*	.79

NOTE: Table A.5 presents the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, male, high school graduate, 18 to 20 years old, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.

Table 15

TWO-YEAR PROBABILITY OF RESERVE ATTRITION TO ACTIVE DUTY  
AMONG THOSE RETURNING TO ACTIVE OR RESERVE FORCES,  
BY COMPONENT AND RESERVIST CHARACTERISTIC

Characteristic	National Guard	Army Reserve
<i>Average attrition probability<sup>a</sup></i>	.86	.68
Race		
<i>Nonblack</i>	.86	.68
Black	.89	.79*
Sex		
<i>Male</i>	.86	.68
Female	.72*	.77*
Education		
<i>High school graduate</i>	.86	.68
High school nongraduate	.79*	.56*
Age		
Less than 18 years	.90*	.79*
18 to 20 years	.86	.68
21 years or older	.71*	.63
Family status		
<i>Single, no dependents</i>	.86	.68
Single, with dependents	.83	.59
Married, no dependents	.77*	.70
Married, with dependents	.82	.60
AFQT		
Category I	.64*	.58
Category II	.86	.69
<i>Category III</i>	.86	.68
Category IV	.60*	.46*
Interactions		
Black, high school nongraduate	.70*	.59*
Black, less than 18 years	.91	.83
Black, 21 years or older	.83	.79
Female, less than 18 years old	.78	.77*
Female, 21 years or older	.59	.64*

NOTE: Table A.6 presents the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, male, high school graduate, 18 to 20 years old, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.

Most losses to the active force or to a reserve component are to the former. As we showed in Table 8, above, the active force accounts for approximately 70 percent to 75 percent of such losses. For both components, those going to active duty are more often high school graduates, younger, and more likely to be in mental category II or III. However, females in the Reserve are more likely to join the active than males; the opposite is true for the Guard.



## V. ANALYZING THE TIMING OF ATTRITION

We have thus far examined overall attrition, i.e., losses during the first two years of service regardless of the timing of attrition. In this section, we develop separate attrition models for two periods: from enlistment to the completion of training and from the completion of training to the end of the second year. The models will allow us to test whether different influences seem to be operating during these periods.

According to our theory, factors influencing early attrition decisions (defined here as attrition prior to or during training) were likely to differ from those leading to posttraining attrition, albeit with a good deal of overlap across the two sets. We had hypothesized that performance and experience attributes would dominate early attrition and mobility attributes would dominate later attrition. We distinguish between these influences because different policies are required to deal with each problem.

Besides discovering different influences in the training and post-training period, we want to analyze the timing of attrition so as to address questions of efficiency regarding attrition. For individuals who cannot meet performance standards, early attrition will minimize training investment, and the presence of unproductive individuals will not impair unit readiness. However, identifying unproductive individuals is uncertain, and training attrition policies can be either lenient or strict with respect to this uncertainty. Strict policies run the risk of separating individuals who if allowed to stay might perform productively. Lenient policies risk allowing individuals to stay who might later leave after a nonproductive period with the unit.

A balanced screening policy requires empirical evidence from the training and posttraining period. The results presented here suggest that guardsmen were screened more stringently than Army reservists during training, allowing some inferences regarding the effects of contrasting policies to be drawn.

### Empirical Results

Tables 16 and 17 show the results of the training and posttraining attrition models for all losses (to civilian life, other components, or the active force), by component, sex, and reservist characteristics. The results (Table 16) indicate that the probability of attrition during training for the reference individual is much higher in the Guard (14

Table 16  
RESERVE PRETRAINING AND TRAINING ATTRITION: ALL LOSSES,  
BY COMPONENT, SEX, AND RESERVIST CHARACTERISTIC  
(Dependent Variable: TRATT)

Characteristic	National Guard		Army Reserve	
	Male	Female	Male	Female
<i>Average attrition probability<sup>a</sup></i>	.14	.37	.08	.12
Race				
<i>Nonblack</i>	.14	.37	.08	.12
Black	.15	.29*	.08	.08*
Education				
<i>High school graduate</i>	.14	.37	.08	.12
High school nongraduate	.22*	.53*	.08	.12
Age				
Less than 18 years	.12*	.28*	.13*	.20*
18 to 20 years	.14	.37	.08	.12
21 years or older	.21*	.35	.07	.12
Family status				
Single, no dependents	.14	.37	.08	.12
Single, with dependents	.14	.40	.07	.24
Married, no dependents	.16*	.44	.07	.11
Married, with dependents	.15*	.45*	.08	.12
AFQT				
Category I	.10*	.24*	.12*	.10
Category II	.11*	.32*	.09*	.12
Category III	.14	.37	.08	.12
Category IV	.20*	.45*	.08	.11
Interactions				
Black, high school nongraduate	.21	.44	.06*	.07
Black, less than 18 years old	.14	.28*	.20*	.20
Black, 21 years or older	.20	.27	.06	.07

NOTE: Tables A.7 and A.8 present the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, high school graduate, 18 to 20 years old, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.

Table 17  
RESERVE POSTTRAINING ATTRITION: ALL LOSSES, BY COMPONENT,  
SEX, AND RESERVIST CHARACTERISTIC  
(Dependent Variable: POSTATT)

Characteristic	National Guard		Army Reserve	
	Male	Female	Male	Female
<i>Average attrition probability<sup>a</sup></i>	.12	.22	.24	.41
Race				
<i>Nonblack</i>	.12	.22	.24	.41
Black	.17*	.23	.32*	.34*
Education				
<i>High school graduate</i>	.12	.22	.24	.41
High school nongraduate	.17*	.28*	.38*	.55*
Age				
Less than 18 years	.11	.19	.21*	.36*
18 to 20 years	.12	.22	.24	.41
21 years or older	.12	.20	.24	.34*
Family status				
Single, no dependents	.12	.22	.24	.41
Single, with dependents	.10	.22	.22	.34
Married, no dependents	.11	.23	.26	.48*
Married, with dependents	.11	.22	.23	.40
AFQT				
Category I	.11	.17	.18*	.28*
Category II	.12	.21	.21*	.37*
Category III	.12	.22	.24	.41
Category IV	.12	.23	.25	.41
Interactions				
Black, high school nongraduate	.22	.25	.41*	.48
Black, less than 18 years old	.15	.18	.25	.24
Black, 21 years or older	.18	.15	.29	.27

NOTE: Tables A.9 and A.10 present the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, high school graduate, 18 to 20 years old, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.

percent for the reference male and 37 percent for the reference female) than in the Reserve (8 percent for the male and 12 percent for the female).

Three hypotheses may help to explain the markedly differing training attrition probabilities by component for similar individuals:

- First, the training standards and qualitative and performance standards of the two components may differ. Training standards may differ because each component requires its own particular skill mix: combat skills for the Guard and combat support skills for the Reserve. Differences in qualitative and performance standards may also stem from pressures to meet end strengths, and each component may raise or lower standards to meet its own needs.<sup>1</sup>
- The second hypothesis involves the basic consistency of the data recorded at enlistment for the Guard and Reserve. In 1980, Guard enlistees were given aptitude tests by Guard recruiters, whereas Reserve personnel were cycled through the Armed Forces Entrance and Examining Stations (AFEES).<sup>2</sup> Test conditions were probably more uniform in the latter case. Biased Guard test scores would result in different training attrition levels for individuals who appear to have similar characteristics.
- Third, the Guard and Reserve preenlistment screening may differ. Individuals from each component may attend a weekend drill prior to enlistment. If this attendance is not uniform by component and if information regarding significant experience or performance attributes is gathered by the individual or component, self-selection and differing training attrition may result.

Some evidence about which of these hypotheses might be correct may be garnered from the posttraining attrition results (Table 17, above). Here, the opposite pattern emerges: The probability of attrition after training is markedly higher in the Reserve (24 percent for

<sup>1</sup>Differences in qualitative and performance standards are not obvious at first, since active, Guard, and Reserve trainees attend both boot and advanced individual training (AIT) together. Since instructors do not know the affiliation of the individual trainees, they presumably enforce standards uniformly for all. Differentiation may take place once the enlistees have been referred to component personnel at the training bases, which make the attrition and recycling decisions. The policies governing these decisions come from the National Guard Bureau (NGB) and state bureaus for the Guard and from the Office of the Chief of Army Reserves for the Reserve. It is difficult to obtain other than anecdotal evidence to support these conjectures.

<sup>2</sup>Guard nonprior-service enlistees began AFEES processing in FY1985.

the reference male and 41 percent for the reference female) than in the Guard (12 percent for the male and 22 percent for the female).

The pattern of lower posttraining attrition rates combined with higher training attrition rates seems to favor the hypothesis that the training standards of the two components differ. If less screening is done during training, then one would expect higher posttraining attrition rates. In contrast, if the component had similar training standards but either self-selection or data discrepancies were present, one would expect higher training attrition, but not necessarily lower post-training attrition.

Other evidence of differing standards comes from the differing effects of the demographic and aptitude variables on training and post-training attrition. For training attrition for Guard males, education, age, marital status, race, and aptitude scores discriminate statistically between those who leave and those who stay. For the Reserve, none of these variables (excluding interaction terms) discriminates during training, and only a single variable—less than 18 years of age—shows a statistically significant effect. These Reserve results show almost a random attrition pattern—at least with respect to the variables available for this analysis—and are consistent with a fairly minimal level of Reserve screening.

The posttraining results (Table 17, above) show the opposite pattern in terms of significance of variables. The Reserve posttraining pattern shows that education, age, and mental category are statistically significant in explaining attrition and in the expected direction. In contrast, the Guard pattern shows a more random pattern in the posttraining period. This appears to lend some credence to the hypothesis that the Reserve follows a more lenient training policy and allows the units to make attrition decisions, while the Guard adopts a more stringent training attrition policy and leaves the unit less to decide.

Tables 16 and 17 (above) show that the different patterns in training and posttraining attrition hold for females as well. The Guard results show a high level of variable discrimination during training with race, education, age, marital status, and aptitude scores all showing strong significance. During the posttraining period, the attrition is nearly random, with only education showing statistical significance. The opposite pattern is evident for the Reserve.

The pattern of these results does not change when we include only civilian losses rather than all losses. The results using both dependent variables for training attrition are not shown here because they are nearly identical (since nearly all attrition during training is to civilian life). However, after training a significant percentage of attrition is to other components or to the active force.

Tables 18 and 19 compare the Guard and Reserve posttraining results using different dependent variables: (1) all losses and (2) losses only to civilian life. The results show that, for our reference Guard male, the probability of loss to civilian life is 6 percent and to all loss categories is 12 percent. For the Guard female, the equivalent percentages are 9 percent and 22 percent. This result shows that for the Guard almost one-half of posttraining attrition occurs within the total force. For the Reserve (Table 19) the posttraining attrition probability for our reference male is 13 percent to civilian life and 24 percent to all categories. For the reference female, the corresponding numbers are 25 percent and 41 percent.

An interesting difference emerges in comparing the Guard male losses to civilian life versus all male losses. Several variables (primarily education, mental category, and race) appear to predict losses to civilian life, but do not predict all losses. For the Army Reserve, most attrition takes place after training, and for both males and females, race, education, age, and mental category significantly affect attrition.

Table 18

ARMY NATIONAL GUARD POSTTRAINING ATTRITION TO  
CIVILIAN LIFE AND TO ALL LOSS CATEGORIES,  
BY SEX AND RESERVIST CHARACTERISTIC  
(Dependent Variable: POSTATTTCIV)

Characteristic	Losses to Civilian Life		All Losses	
	Male	Female	Male	Female
<i>Average attrition probability<sup>a</sup></i>	.06	.09	.12	.22
Race				
<i>Nonblack</i>	.06	.09	.12	.22
Black	.09*	.10	.17*	.23
Education				
<i>High school graduate</i>	.06	.09	.12	.22
High school nongraduate	.11*	.12	.17*	.28*
Age				
Less than 18 years	.05*	.09	.11	.19
18 to 20 years	.06	.09	.12	.22
21 years or older	.06	.09	.12	.20
Family status				
Single, no dependents	.06	.09	.12	.22
Single, with dependents	.06	.09	.10	.22
Married, no dependents	.06	.09	.11	.23
Married, with dependents	.05	.08	.11	.22
AFQT				
Category I	.05*	.05*	.11	.17
Category II	.05*	.08	.12	.21
Category III	.06	.09	.12	.22
Category IV	.07*	.08	.12	.23
Interactions				
Black, high school nongraduate	.15	.12	.22	.25
Black, less than 18 years old	.06*	.07	.15	.18
Black, 21 years or older	.10	.06	.18	.15

NOTE: Tables A.9, A.10, and A.11 present the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, high school graduate, 18 to 20 years, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.

Table 19

ARMY RESERVE POSTTRAINING ATTRITION TO CIVILIAN LIFE AND TO  
TO ALL LOSS CATEGORIES, BY SEX AND RESERVIST CHARACTERISTIC

(Dependent Variable: POSTATTTCIV)

	Losses to Civilian Life		All Losses	
	Male	Female	Male	Female
<i>Average attrition probability<sup>a</sup></i>	.13	.25	.24	.41
Race				
<i>Nonblack</i>	.13	.25	.24	.41
Black	.17*	.20*	.32*	.34*
Education				
<i>High school graduate</i>	.13	.25	.24	.41
High school nongraduate	.25*	.36*	.38*	.55*
Age				
Less than 18 years	.10*	.21*	.21*	.36*
18 to 20 years	.13	.25	.24	.41
21 years or older	.15*	.21*	.24	.34*
Family status				
Single, no dependents	.13	.25	.24	.41
Single, with dependents	.12	.21	.22	.34
Married, no dependents	.13	.28	.26	.48*
Married, with dependents	.13	.24	.23	.40
AFQT				
Category I	.08*	.17*	.18*	.28*
Category II	.11*	.22*	.21*	.37*
Category III	.13	.25	.24	.41
Category IV	.16*	.25	.25	.41
Interactions				
Black, high school nongraduate	.30	.36	.41*	.48
Black, less than 18 years old	.11	.13	.25	.24
Black, 21 years or older	.17	.16	.29	.27

NOTE: Tables A.9, A.10, and A.12 present the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, high school graduate, 18 to 20 years old, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.



## VI. CONCLUSIONS

### FACTORS CONTRIBUTING TO SEPARATION

The two Army Selected Reserve components experience high levels of separation among nonprior-service (NPS) enlistees during their first term. Approximately 40 percent of NPS Army reservists and 30 percent of NPS Army guardsmen separate within two years of enlistment. Reasonable extrapolations of these attrition rates to the complete six-year term would show that fewer than four in ten guardsman and one in four Army reservists finish their term. This study hypothesizes that the following three factors contribute to the high rate of reservist separation:

- The quality and demographic composition of the enlistment cohort
- Transfers to the active force or to reserve components
- For moonlighting reservists, the turbulence of normal civilian life associated with entry into the full-time labor force and family formation.

### Quality and Demographic Composition of Cohort

Army Selected Reserve attrition is very sensitive to the mental aptitude scores, educational attainment, and demographic composition of the enlistment cohort. As was found to be the case in active force attrition studies, the probability of reserve force attrition increases strongly among recruits with lower educational attainment or lower AFQT scores. Other things equal, the two-year separation rate for Guard males increased from 23 percent for high school graduates to 35 percent for high school nongraduates. For the Reserve, the equivalent rates rose from 29 percent to 42 percent. With respect to mental category, other things equal, Guard males in Category I separated at an 18 percent rate, in contrast to 29 percent for Category IV. For the Reserve, the equivalent rates were 24 percent and 31 percent.

The reserve components could reduce attrition by recruiting a higher percentage of individuals with high school diplomas and/or from the upper mental categories. Estimates derived from our attrition equations show that a 20 percent increase in the proportion of high school graduates, holding other things constant, would reduce overall attrition

by 8 percent for both the Guard and Reserve. More specifically, a 20 percent increase in the proportion of high school graduates in the Army Reserve from the FY1980 level of 53.3 percent to 64 percent would decrease separation rates in the first two years from 39.5 percent to 36.4 percent. Similarly, such an increase in the Army National Guard would lower attrition rates from 30.6 percent to 28.2 percent in the first two years.

The direction and size of the effects of education and AFQT scores were consistent for both men and women. Since women enlistees, on average, entered with significantly higher AFQT scores and years of education than men, one would have expected lower overall attrition among women. However, we found large, significant differences in attrition rates between men and women with similar AFQT, education, and other characteristics. Other things equal, women have approximately twice the attrition rates of men. This difference more than offsets the higher quality of women enlistees and leads to higher overall attrition among women than men for the FY1980 cohort. The attrition rate during the first two years of service was 46.6 percent for women in the National Guard, in contrast to 28.9 for men; in the Reserve the rate was 45.1 percent for women and 36.7 percent for men.

Several hypotheses may help to explain the difference in attrition between men and women. Adaptation to the military training environment may differ for men and women, particularly in the context of a part-time job. Once trained, women may find it harder to keep the reserve commitment because of earlier marriage, childbearing, more frequent geographical moves, and more frequent spousal conflict. The higher proportion of women in the Army Reserve than in the National Guard may indicate migration into nontraditional jobs, such as maintenance, electronic repair, and transportation, which might have higher attrition than the more traditional jobs, such as clerical and medical support. We need additional data and analyses to distinguish among these hypotheses.

### **Transfers to Active Force or Selected Reserves**

The second major hypothesis about reserve attrition concerned transfers among Armed Services components. We distinguish in this study between losses to civilian life and losses to the active force or to reserve components (including separations and returns to the same component). We find that 28 percent of the separations from the Army Reserve in the first two years were to the active force or to another selected reserve component, or a return to the Army Reserve

after a period of separation. Only 17 percent of Guard separations are attributable to this type of loss.

Transfers to the active force account for 70 percent to 75 percent of intercomponent separations; thus, about one in five Army reservist separations and one in eight Guard separations is to the active force. Our analysis shows that those transferring to the active force are of significantly higher quality than those returning to the Reserve or civilian life. Moreover, those returning to the Reserve are of higher quality than those lost to civilian life.

Army reservists may find it easier to enlist in the active force thanks to a prior relationship with Army recruiters, who recruit for both the Reserve and active Army. Guard enlistees are recruited by Guard recruiters, who recruit only for the National Guard. Transfer between the Reserve and active Army is also governed by policies on prior-service enlistments in the active Army. A reservist must enlist in the active force as a prior-service enlistee, and the number transferring may depend on prior-service accession requirements, standards, and skill demands.

### **Changes in Reservist's Civilian Life**

A third hypothesis focuses on the turbulence of normal civilian life experienced by reservists, who are typically entering the full-time labor force and/or setting up new households. Geographic moves (which would require new unit affiliation) may accompany new job opportunities, new marriages, and/or increased family size. Changes in employment or household composition may lead to conflicts with family members or employers. Our analysis provides only indirect evidence of the importance of these factors to attrition. We find that the higher attrition rate of women and nonblacks is consistent with a pattern of higher attrition for groups who migrate more, marry earlier, and change jobs more frequently. A further linking of our data set with reserve survey data would help to test these hypotheses.

### **POLICY IMPLICATIONS AND FUTURE RESEARCH**

Our results bear on a number of intriguing policy questions, albeit questions that cannot be fully addressed in the absence of several other

analyses in the field of reserve manpower. These results might affect four major areas of reserve and active personnel policy:

- Recruiting standards and resources
- Employer and family support policies
- The mix of prior- and nonprior-service enlistments
- Policies concerning intercomponent transfers.

This analysis alone cannot answer the question of whether additional recruiting resources would be cost effective. Additional recruiting resources would increase the percentage of high-quality enlistees, reduce attrition and accession requirements, and thereby lower training costs. The results do confirm the importance of targeting recruiting resources on higher mental category and educational groups.

By extending this analysis, we could estimate (1) the reduction in accessions if higher-quality cohorts were enlisted and (2) the resulting savings in training costs. However, we do not yet know the marginal cost of obtaining additional high-quality enlistees; such information can be derived only from a reserve enlistment supply model. To date, a reliable nonprior-service enlistment supply model has not been estimated, although sufficient data are now available to do so. Such a model, when combined with the attrition analysis, would provide guidance as to the cost-effective level of recruiting resources.

The high separation rate for nonprior-service reservists raises the question of using prior-service reservists instead. Prior-service personnel often need no further training; moreover, they probably have higher productivity than nonprior-service enlistees for similar years of service. A similar attrition analysis and enlistment supply model needs to be estimated for prior-service enlistees to determine the most cost-effective mix. The substitution potential will certainly depend on the type of skill and training costs, the grade position in the unit, and the effect on unit morale of lateral entry of prior-service reservists who decrease promotion potential for nonprior-service enlistees.

Employer and family support policies have traditionally been viewed as supporting reenlistment decisions rather than preventing early attrition. The frequent changing of employers for this group and the more junior position of the reservist complicates the development of policies to reduce attrition. Family support issues may also differ for new spouses and younger children. Better identification of these problems through surveys or interviews would aid in the formulation of policies directed specifically at early attrition.

Improved information is also needed regarding intercomponent transfers. We have shown that the levels of such transfers constitute a

significant share of Reserve attrition. We often do not know the motivation for such transfers, nor the extent to which it would be possible to reduce attrition further through improved transfer policies. For instance, how many reservists are lost through geographical moves, and would improved centralized data systems listing reserve job vacancies decrease these losses? Should linkups be made prior to moves, and should intercomponent transfers be made easier? Should transfers to the active force be encouraged? Additional information obtained through surveys of individuals who transferred or moved would greatly improve decisionmaking in this area.

Two approaches are often suggested for addressing attrition problems: raising the costs to individuals of attrition and increasing the benefits of staying. The Reserve and Guard have legal penalties for noncompliance with the term of commitment, including imprisonment for missing drills, call-up to full-time active duty, and courts-martial. In many cases, the costs of both carrying out these penalties and keeping unwilling members may be excessive. The effectiveness of some penalties can be empirically tested for the National Guard, as state enforcement standards differ. The effects of state policies are currently being measured.

The second approach would restructure incentives so as to encourage finishing the term. At present, a disproportionate share of pay and benefits goes to the reservists during the initial 4- to 12-month training period, whereas the return to the reserve component in terms of individual productivity occurs later in the term. Reservists get full-time pay during initial active-duty training (IADT) and the benefits of learning a skill.

In 1980, a reservist who qualified for a \$2000 bonus and attended IADT for four months would earn \$3400 during the first year. This would fall to \$1400 the second year and increase slightly to \$1700 in the fifth year. For skills requiring longer IADT, the imbalance is even greater. On the other hand, the individual's productivity probably rises during the entire first term, so that the final years are more valuable than the initial years. In general, additional enlistment incentives and reserve pay restructuring should probably be aimed at synchronizing the timing of benefits to the reservist and to the component during the first term.

One policy worth experimenting with is a completion bonus, to be paid at the end of the term. Bonuses could be paid as part of the existing enlistment bonus program. Such bonuses could be designed to account for different skills or different training investment costs. Experiments could be relatively easy to design, since they could take place at the individual level with relatively small sample sizes.

Finally, we should emphasize the role of institutional policies in determining Reserve attrition levels. Attrition levels can be managed to help meet end-strength and budgetary goals for the Reserve or, alternatively, to meet active force end-strength. Lenient attrition policies can be used to build strength, at least temporarily. Strict policies can be used to reduce strength when necessary. Data on several cohorts would have to be analyzed to measure some of these effects. If the effects are large, policy conclusions based on the analysis of a single cohort would run considerable risk.

An analysis of the FY1981—FY1983 cohort data, however, would encompass a period when reserve strength was high and end-strength levels were easily met. It would also span both good and bad recruiting times for the active force; the effects of these policies on Army Reserve recruiting could then be estimated.

## Appendix A

### REGRESSION COEFFICIENTS FOR ARMY NATIONAL GUARD AND ARMY RESERVE TWO-YEAR ATTRITION MODELS

Table A.1

REGRESSION COEFFICIENTS FOR ARMY NATIONAL GUARD TWO-YEAR  
ATTRITION MODEL: LOSSES TO CIVILIAN LIFE OR IRR, BY SEX

Independent Variable	Dependent Variable: ATTRITCIV			
	Male		Female	
	Coeff	t-stat	Coeff	t-stat
Constant	-1.51		-0.24	
Black	0.28	6.21*	-0.34	3.25*
High school nongraduate	0.73	25.79*	0.74	7.60*
Less than 18 years old	-0.22	7.45*	-0.41	4.21*
21 years or older	0.41	10.93*	-0.14	1.63
Single, with dependents	0.01	0.16	0.12	0.73
Married, no dependents	0.17	2.97*	0.25	1.98*
Married, with dependents	0.05	0.92	0.28	2.07*
Category I	-0.48	6.42*	-0.76	5.76*
Category II	-0.30	9.57*	-0.27	3.59*
Category IV	0.40	10.53*	0.25	1.94
Black, high school nongraduate	-0.13	2.05*	-0.08	0.38
Black, less than 18 years old	-0.07	0.96	0.27	1.38
Black, 21 years or older	-0.10	1.40	-0.10	0.66

\*Significant at .05 level.

Table A.2

REGRESSION COEFFICIENTS FOR ARMY RESERVE TWO-YEAR  
ATTRITION MODEL: LOSSES TO CIVILIAN LIFE OR IRR, BY SEX

Independent Variable	Dependent Variable: ATTRITCIV			
	Male		Female	
	Coeff	t-stat	Coeff	t-stat
Constant	-1.47		-0.61	
Black	0.22	3.11*	-0.38	4.42*
High school nongraduate	0.66	14.41*	0.53	8.11*
Less than 18 years old	-0.21	4.23*	0.03	0.41
21 years or older	0.17	2.78*	-0.08	1.12
Single, with dependents	-0.07	0.38	0.05	0.10
Married, no dependents	0.02	0.20	0.13	1.43
Married, with dependents	-0.03	0.35	0.01	0.15
Category I	-0.47	3.94*	-0.50	3.64*
Category II	-0.20	3.58*	-0.18	3.06*
Category IV	0.20	3.93*	0.03	0.43
Black, high school nongraduate	-0.16	1.40	0.10	0.87
Black, less than 18 years old	0.01	0.14	-0.07	0.48
Black, 21 years or older	-0.19	1.96*	-0.19	1.70

\*Significant at .05 level.



Table A.3  
REGRESSION COEFFICIENTS FOR ARMY NATIONAL GUARD TWO-YEAR  
ATTRITION MODEL: ALL LOSSES, BY SEX

Independent Variable	Dependent Variable: ATTRIT			
	Male		Female	
	Coeff	t-stat	Coeff	t-stat
Constant	-1.18		0.02	
Black	0.29	7.08*	-0.26	2.52*
High school nongraduate	0.56	21.38*	0.57	6.01*
Less than 18 years old	-0.12	4.25*	-0.36	3.76*
21 years or older	0.30	8.80*	-0.15	1.74
Single, with dependents	-0.05	0.99	0.09	0.60
Married, no dependents	0.11	1.97*	0.23	1.81
Married, with dependents	0.03	0.60	0.20	1.49
Category I	-0.32	4.67*	-0.64	4.97*
Category II	-0.15	5.14*	-0.19	2.56*
Category IV	0.29	8.14*	0.23	1.78
Black, high school nongraduate	-0.17	2.98*	-0.02	0.11
Black, less than 18 years old	0.01	0.14	0.21	1.12
Black, 21 years or older	-0.07	1.13	-0.14	0.99

\*Significant at .05 level.

Table A.4  
REGRESSION COEFFICIENTS FOR ARMY RESERVE TWO-YEAR  
ATTRITION MODEL: ALL LOSSES, BY SEX

Independent Variable	Dependent Variable: ATTRIT			
	Male		Female	
	Coeff	t-stat	Coeff	t-stat
Constant	-0.88		-0.09	
Black	0.36	5.50*	-0.33	4.07*
High school nongraduate	0.57	13.82*	0.50	8.07*
Less than 18 years old	-0.04	0.94	-0.02	0.28
21 years or older	0.03	0.51	-0.23	3.37*
Single, with dependents	-0.06	0.39	0.06	0.14
Married, no dependents	0.12	1.32	0.23	2.74*
Married, with dependents	-0.02	0.23	0.02	0.19
Category I	-0.28	2.61*	-0.57	4.37*
Category II	-0.11	2.23*	-0.15	2.68*
Category IV	0.08	1.78	0.01	0.12
Black, high school nongraduate	-0.31	4.13*	-0.05	0.43
Black, less than 18 years old	-0.04	0.41	-0.15	0.99
Black, 21 years or older	-0.19	2.20*	-0.13	1.22

\*Significant at .05 level.

Table A.5  
REGRESSION COEFFICIENTS FOR TWO-YEAR ATTRITION MODEL:  
LOSSES TO CIVILIAN LIFE OR IRR, BY COMPONENT

Independent Variable	Dependent Variable: ATTRITCIV			
	National Guard		Army Reserve	
	Coeff	t-stat	Coeff	t-stat
Constant	1.42		0.58	
Black	0.04	0.50	-0.18	2.01*
Female	0.67	6.78*	0.52	6.26*
High school nongraduate	0.84	14.67*	0.53	7.57*
Less than 18 years old	-0.54	8.30*	-0.46	6.19*
21 years or older	0.48	6.62*	0.43	4.78*
Single, with dependents	0.25	2.14*	-0.06	0.22
Married, no dependents	0.21	2.07*	-0.11	1.09
Married, with dependents	0.12	1.32	0.01	0.15
Category I	-0.93	5.96*	-0.41	2.53*
Category II	-0.75	11.53*	-0.21	3.30*
Category IV	0.35	5.09*	0.25	3.85*
Black, high school nongraduate	-0.02	0.15	0.29	2.87*
Black, less than 18 years old	-0.16	1.15	0.16	1.16
Black, 21 years or older	-0.17	1.33	-0.19	1.61
Female, high school nongraduate	-0.24	1.56	-0.27	2.70*
Female, less than 18 years old	0.31	1.76	0.58	4.70*
Female, 21 years or older	-0.39	2.68*	-0.19	1.65

\*Significant at .05 level.

Table A.6  
REGRESSION COEFFICIENTS FOR THOSE RETURNING  
TO ACTIVE OR RESERVE FORCES

Independent Variable	National Guard		Army Reserve	
	Coeff	t-stat	Coeff	t-stat
Constant	1.79		0.74	
Black	0.28	1.49	0.59	3.87*
Female	-0.87	3.53*	0.48	3.29*
High school nongraduate	-0.46	3.18*	-0.48	4.01*
Less than 18 years old	0.40	2.98*	0.57	4.52*
21 years or older	-0.91	4.88*	-0.22	1.29
Single, with dependents	-0.23	0.79	-0.36	0.70
Married, no dependents	-0.59	2.12*	0.11	0.57
Married, with dependents	-0.24	0.98	-0.34	1.83
Category I	-1.22	4.33*	-0.43	1.66
Category II	0.06	0.48	0.08	0.72
Category IV	-1.40	6.59*	-0.90	6.92*
Black, high school nongraduate	-0.76	2.41*	-0.49	2.49*
Black, less than 18 years old	-0.13	0.44	-0.30	1.25
Black, 21 years or older	0.39	1.23	0.23	1.01
Female, high school nongraduate	0.18	0.32	0.22	1.12
Female, less than 18 years old	-0.09	0.20	-0.58	2.41*
Female, 21 years or older	0.36	0.94	-0.43	1.96*

\*Significant at .05 level.

Table A.7

REGRESSION COEFFICIENTS FOR PRETRAINING AND TRAINING  
ATTRITION MODEL: ALL MALE LOSSES, BY COMPONENT

Independent Variable	Dependent Variable: TRATT			
	National Guard		Army Reserve	
	Coeff	t-stat	Coeff	t-stat
Constant	-1.83		-2.51	
Black	0.09	1.88	0.04	0.42
High school nongraduate	0.57	18.38*	-0.001	0.01
Less than 18 years old	-0.14	4.13*	0.60	8.11*
21 years or older	0.48	11.57*	-0.02	0.19
Single, with dependents	0.01	0.15	-0.03	0.09
Married, no dependents	0.21	3.24*	-0.10	0.68
Married, with dependents	0.13	2.30*	0.02	0.20
Category I	-0.37	4.31*	0.51	2.81*
Category II	-0.25	7.25*	0.23	2.79*
Category IV	0.45	10.78*	0.00	0.07
Black, high school nongraduate	-0.13	1.94	-0.31	2.52*
Black, less than 18 years old	0.09	1.12	0.49	3.10*
Black, 21 years or older	-0.12	1.54	-0.25	1.71

\*Significant at .05 level.

Table A.8

REGRESSION COEFFICIENTS FOR PRETRAINING AND TRAINING  
ATTRITION MODEL: ALL FEMALE LOSSES, BY COMPONENT

Independent Variable	Dependent Variable: TRATT			
	National Guard		Army Reserve	
	Coeff	t-stat	Coeff	t-stat
Constant	-0.51		-2.00	
Black	-0.39	3.61*	-0.37	2.97*
High school nongraduate	0.63	6.28*	0.03	0.34
Less than 18 years old	-0.43	4.20*	0.60	4.95*
21 years or older	-0.12	1.33	0.03	0.28
Single, with dependents	0.12	0.75	0.84	1.20
Married, no dependents	0.26	1.95	-0.09	0.65
Married, with dependents	0.30	2.15*	0.05	0.44
Category I	-0.62	4.48*	-0.19	0.95
Category II	-0.25	3.21*	-0.02	0.22
Category IV	0.32	2.38*	-0.04	0.38
Black, high school nongraduate	0.02	0.10	-0.23	1.38
Black, less than 18 years old	0.41	2.00*	0.41	1.82
Black, 21 years or older	0.04	0.29	-0.17	1.04

\*Significant at .05 level.

Table A.9  
REGRESSION COEFFICIENTS FOR POSTTRAINING ATTRITION MODEL:  
ALL MALE LOSSES, BY COMPONENT

Independent Variable	Dependent Variable: POSTATT			
	National Guard		Army Reserve	
	Coeff	t-stat	Coeff	t-stat
Constant	-2.04		-1.17	
Black	-0.46	7.88*	0.42	6.01*
High school nongraduate	0.45	11.81*	0.68	15.00*
Less than 18 years old	-0.06	1.63	-0.16	3.19*
21 years or older	0.02	0.47	0.03	0.54
Single, with dependents	-0.11	1.47	-0.09	0.50
Married, no dependents	-0.03	0.41	0.14	1.45
Married, with dependents	-0.08	1.17	-0.02	0.31
Category I	-0.07	0.76	-0.32	2.78*
Category II	0.03	0.77	-0.15	2.82*
Category IV	0.06	1.04	0.08	1.66
Black, high school nongraduate	-0.16	1.82	-0.30	3.69*
Black, less than 18 years old	-0.10	1.00	-0.18	1.66
Black, 21 years or older	0.06	0.59	-0.17	1.75

\*Significant at .05 level.

Table A.10  
REGRESSION COEFFICIENTS FOR POSTTRAINING ATTRITION MODEL:  
ALL FEMALE LOSSES, BY COMPONENT

Independent Variable	Dependent Variable: POSTATT			
	National Guard		Army Reserve	
	Coeff	t-stat	Coeff	t-stat
Constant	-1.27		-0.38	
Black	0.06	0.37	-0.27	3.02*
High school nongraduate	0.33	2.08*	0.59	8.57*
Less than 18 years old	-0.16	1.13	-0.19	2.10*
21 years or older	-0.13	1.02	-0.29	3.81*
Single, with dependents	-0.01	0.06	-0.27	0.51
Married, no dependents	0.09	0.44	0.29	3.10*
Married, with dependents	-0.003	0.01	-0.01	0.12
Category I	-0.34	1.85	-0.57	4.04*
Category II	-0.03	0.27	-0.16	2.65*
Category IV	0.04	0.19	0.01	0.15
Black, high school nongraduate	-0.20	0.63	-0.03	0.22
Black, less than 18 years old	-0.16	0.55	-0.31	1.88
Black, 21 years or older	-0.41	1.92	-0.08	0.69

\*Significant at .05 level.



Table A.11

REGRESSION COEFFICIENTS FOR ARMY NATIONAL GUARD POSTTRAINING  
ATTRITION MODEL: LOSSES TO CIVILIAN LIFE OR IRR, BY SEX

Independent Variable	Dependent Variable: POSTATTTCIV			
	Male		Female	
	Coeff	t-stat	Coeff	t-stat
Constant	2.81		-2.31	
Black	0.53	7.49*	0.09	0.51
High school nongraduate	0.067	15.00*	0.31	1.84
Less than 18 years old	-0.18	3.86*	-0.06	0.38
21 years or older	0.004	0.07	-0.03	0.22
Single, with dependents	0.01	0.06	0.02	0.08
Married, no dependents	-0.01	0.14	-0.07	0.30
Married, with dependents	-0.12	1.44	-0.005	0.02
Category I	-0.25	2.06*	-0.56	2.45*
Category II	-0.18	3.69*	-0.15	1.16
Category IV	0.16	2.67*	-0.13	0.58
Black, high school nongraduate	-0.11	1.12	-0.07	0.22
Black, less than 18 years old	-0.31	2.59*	-0.30	0.89
Black, 21 years or older	0.08	0.72	-0.48	1.89

\*Significant at .05 level.

Table A.12

REGRESSION COEFFICIENTS FOR ARMY RESERVE POSTTRAINING  
ATTRITION MODEL: LOSSES TO CIVILIAN LIFE OR IRR, BY SEX

Independent Variable	Dependent Variable: POSTATTTCIV			
	Male		Female	
	Coeff	t-stat	Coeff	t-stat
Constant	-1.90		-1.12	
Black	0.28	3.49*	-0.26	2.79*
High school nongraduate	0.78	15.35*	0.56	7.78*
Less than 18 years old	-0.34	6.18*	-0.20	2.19*
21 years or older	0.15	2.25*	-0.18	2.28*
Single, with dependents	-0.08	0.42	-0.21	0.39
Married, no dependents	0.02	0.21	0.19	1.92
Married, with dependents	-0.05	0.56	-0.02	0.25
Category I	-0.52	3.94*	-0.44	2.89*
Category II	-0.24	3.84*	-0.15	2.35*
Category IV	0.21	3.79*	0.03	0.37
Black, high school nongraduate	-0.03	0.29	0.24	1.89
Black, less than 18 years old	-0.18	1.52	-0.32	1.87
Black, 21 years or older	-0.11	1.03	-0.10	0.84

\*Significant at .05 level.

## Appendix B

### TESTS OF STABILITY OF COEFFICIENTS

As seen in Secs. IV and V, the regression models were fitted separately to each Army component service and within service each component separately to the male and female cohorts. In addition, models of pretraining and training attrition and of posttraining attrition were estimated separately. To test statistically the validity of our assumption that in each case the relevant groups were inherently different, we used (a) the Chow test to test for the equality of the two *sets of coefficients* and (b) a dummy variable interaction method to pinpoint more precisely *which coefficients* differed. For the Chow test, the hypothesis that  $\beta_i = \beta_j = \beta$  (where  $i$  and  $j$  refer to the different groups and  $\beta$  is a vector of coefficients) may be tested by computing the F ratio:

$$\frac{(Q_2 - Q_1)(N_i + N_j - 2k)}{Q_2k}$$

where  $Q_2$  - total of the sums of squared residuals from the separate regressions estimated on the  $i$  and  $j$  groups,

$Q_1$  - sum of squared residuals from the pooled regression ( $i + j$ ),

$k$  - number of explanatory variables, and

$n_i, n_j$  - number of observations in the  $i, j$  groups, respectively.

The second method involves estimating a pooled regression with a full set of interaction terms created by multiplying a dummy variable ( $= 1$  if belonging to  $j^{\text{th}}$  group, 0 otherwise) with all explanatory variables. The coefficients of these interaction terms and their t-statistics indicate whether the variable differs significantly in its effect on the  $j^{\text{th}}$  group, as opposed to the  $i^{\text{th}}$  group.

In the test of stability of coefficients across components, two-year attrition model, the computed F-statistic was 1050.55. The null hypothesis of equality of coefficients for the Guard and Reserve was, therefore, rejected at the .01 level.

Table B.1 shows which coefficients differed significantly between the Guard and the Reserve in the pooled regression. While the marital

status variables and most of the age variables do not differ significantly, the sex and mental category variables all strongly differ in their effect on attrition for the two components; the intercept term is also strongly significant.

In the test of stability of coefficients across the male and female cohorts, two-year attrition model, the computed F-statistic was 25.89 for the Army Reserve and 58.98 for the Army National Guard. The null hypothesis of equality was, therefore, rejected at the .01 level.

Table B.2 presents the t-statistics indicating which coefficients differed significantly across males and females. Race, age, and mental category (Category I) all differ significantly, as did the intercept term.

In the test of stability of coefficients across the (1) pretraining-training and (2) posttraining attrition models, we could not use the Chow test as the dependent variable itself differed. Table B.3 presents the t-statistics for the differences in coefficients for the two time periods. Race, sex, and education all differ significantly in their effects on attrition during the two time periods.

Table B.1

## RESULTS OF t-TESTS OF POOLED GUARD AND RESERVE DATA

Variable	t-statistic
Intercept	-3.66*
Black	0.43
Female	5.74*
High school nongraduate	-2.53*
Less than 18 years old	-2.96*
21 years or older	1.89
Single, with dependents	0.19
Married, no dependents	1.25
Married, with dependents	0.65
Category I	-2.69*
Category II	-1.71
Category IV	3.20*
Black, high school nongraduate	1.52
Black, less than 18 years old	0.38
Black, 21 years or older	2.45*
Female, high school nongraduate	0.61
Female, less than 18 years old	-1.45
Female, 21 years or older	-0.65*

\*Significant at .05 level.

Table B.2  
RESULTS OF t-TESTS OF POOLED MALE AND FEMALE DATA

Variable	t-statistic	
	Army National Guard	Army Reserve
Intercept	18.37*	11.87*
Black	-4.85*	-6.69*
High school nongraduate	0.94	-0.85
Less than 18 years old	-3.05*	-0.46
21 years or older	-4.63*	-3.02*
Single, with dependents	0.76	0.16
Married, no dependents	1.02	1.10
Married, with dependents	1.37	0.03
Category I	-2.98*	-2.70*
Category II	-1.04	-1.26
Category IV	-0.10	-0.89
Black, high school nongraduate	0.56	1.95
Black, less than 18 years old	1.05	-0.50
Black, 21 years or older	-0.90	0.61

\*Significant at .05 level.

Table B.3

## RESULTS OF t-TESTS OF POOLED TRAINING AND POSTTRAINING DATA

Variable	t-statistic	
	Army National Guard	Army Reserve
Intercept	114.79*	30.77*
Black	-3.63*	-0.77
Female	-6.28*	-4.85*
High school nongraduate	-6.01*	-5.87*
Less than 18 years old	0.83	1.28
21 years or older	-0.24	0.44
Single, with dependents	0.72	0.08
Married, no dependents	0.23	-0.96
Married, with dependents	0.64	0.18
Category I	0.27	1.45
Category II	-0.51	1.14
Category IV	-0.72	-0.42
Black, high school nongraduate	0.72	0.45
Black, less than 18 years	0.62	0.80
Black, 21 years or older	0.48	0.89

\*Significant at .05 level.

## **Appendix C**

### **REGRESSION RESULTS FOR THE COMBINED MALE-FEMALE TWO-YEAR ATTRITION MODEL**

When males and females are combined, the reference individual is defined as a single, nonblack, male high school graduate, between 18 and 20 years old and in the 31st to 64th percentile on the ASVAB. As expected from our earlier results, the effect of changing the reference sex characteristic from male to female for civilian losses changes the attrition rate from 20 to 46 for the Guard and 20 to 36 for the Reserve. The direction and significance of the remaining variables is very similar to the earlier results; however, a larger number of interaction terms are included and are significant. The significance of so many interaction terms with the sex variable indicates that males and females have different attrition patterns, and these terms provided the original motivation for analyzing males and females separately.



Table C.1

TWO-YEAR RESERVIST ATTRITION PROBABILITIES FOR ALL LOSSES,  
BY COMPONENT AND RESERVIST CHARACTERISTIC

Characteristic	Dependent Variable: ATTRIT	
	National Guard	Army Reserve
<i>Reference individual<sup>a</sup></i>	.24	.31
Race		
<i>Nonblack</i>	.24	.31
Black	.19*	.23*
Sex		
<i>Male</i>	.24	.31
Female	.52*	.47*
Education		
<i>High school graduate</i>	.24	.32
High school nongraduate	.35*	.42*
Age		
Less than 18 years	.21*	.30
18 to 20 years old	.24	.31
21 years or older	.29*	.31
Family status		
Single, no dependents	.24	.31
Single, with dependents	.24	.30
Married, no dependents	.24*	.36*
Married, with dependents	.25	.30
AFQT		
Category I	.16*	.21*
Category II	.19*	.27*
Category III	.24	.31
Category IV	.30*	.33
Interactions		
Black, male	.34*	.63*
Black, high school nongraduate	.21*	.25*
Black, less than 18 years old	.23	.28
Black, 21 years or older	.21	.27*
Female, high school nongraduate	.27*	.31
Female, less than 18 years old	.19*	.30
Female, 21 years or older	.16*	.25*

NOTE: Table C.2 presents the regression coefficients used to derive the probabilities in this table.

<sup>a</sup>Of individual with reference characteristics: nonblack, male, high school graduate, 18 to 20 years old, single, Category III (shown in this table in italic).

\*Differs significantly from reference category at .05 level, two-tailed test.

Table C.2  
REGRESSION COEFFICIENTS FOR TWO-YEAR ATTRITION MODEL  
FOR ALL LOSSES, BY COMPONENT

Independent Variable	Dependent Variable: ATTRIT			
	National Guard		Army Reserve	
	Coeff	t-ratio	Coeff	t-ratio
Constant	-1.18		-0.86	
Black	-0.24	3.11*	-0.28	4.49*
Female	1.26	21.54*	0.74	13.74*
High school nongraduate	0.55	21.15*	0.53	13.84*
Less than 18 years old	-0.12	4.31*	-0.04	0.84
21 years or older	0.30	8.98*	0.01	0.27
Single, with dependents	-0.04	0.74	-0.04	0.28
Married, no dependents	0.12	2.48*	0.18	2.87*
Married, with dependents	0.05	1.03	-0.001	0.01
Category I	-0.40	6.49*	-0.40	4.78*
Category II	-0.16	5.68*	-0.13	3.41*
Category IV	0.28	8.28*	0.06	1.49
Black male	0.52	6.76*	0.59	9.38*
Black, high school nongraduate	-0.16	2.86*	-0.22	3.60*
Black, less than 18 years old	0.03	0.50	-0.07	0.90
Black, 21 years or older	-0.09	1.47	-0.16	2.44*
Female, high school nongraduate	0.19	2.10*	0.05	0.86
Female, less than 18 years old	-0.27	2.84*	-0.01	0.11
Female, 21 years or older	-0.49	6.31*	-0.23	3.52*

\*Significant at .05 level.

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→ This report analyzes nonprior service attrition in the Army Reserve and Army National Guard, and is an extension of work reported earlier in W-2079-RA. It develops models of attrition that assign a probability of attrition to each recruit type, thus providing a basis for setting improved enlistment standards. Study results show that, similar to Active Force attrition studies, separation rates for both the Army National Guard and Army Reserve are sensitive to the education, aptitude scores and demographic composition of the enlistment cohort. Results also show that many reservists separate in order to enter an Active or another Reserve component, or to later return to the same component. ↗